The Madras Agricultural Journal.

Vol. XXVII--1939

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The Madras Agricultural Journal.
(ORGAN OF THE M. A. S. UNION)

Vol. XXVII.] JANUARY 1939 [No. 1.

EDITORIAL

New Year Greetings. We wish all our readers a happy and prosperous New Year. We also take this opportunity to thank them and others who have helped us in various ways in the conduct of the Journal during the past year and hope that they will continue to give us their patronage this year also.

With 1939 the *Madras Agricultural Journal* has entered on its twenty-seventh year. It has usefully subserved the fostering of scientific agriculture. As an independent unsubsidized journal its continuance depends on the continued support and patronage of all those interested in agriculture both inside and outside the province; we appeal to every one of them tc extend this support in a greater measure.

We are also anxious to make further improvements in the Journal by publishing larger number of papers and also by introducing other attractive features. This will be possible only with the receipt of suitable contributions and an increase in the membership of the Union and the number of subscribers. We would therefore appeal to all those members of the Department who have not yet become members of the Union to do so at the earliest opportunity and bring in as many subscribers as possible to the fold and thus help in the efficient running of the Journal.

The Indian Science Congress. The Twenty-eighth annual meeting of the Indian Science Congress was held at Lahore from the 2nd to 8th January 1939 under the Presidency of Prof. J. C. Ghosh, D. Sc., F. N. I., Professor of Chemistry, Dacca. Dr. T. V. Ramakrishna Ayyar, B. A., Ph. D., retired Entomologist to the Government of Madras and a member of our Union presided over the Agricultural Section. In his masterly address on 'Insects and their role in Indian Agriculture' he dealt in detail with the extent of damage and loss to crops due to insect pests and the various methods of pest control. The concluding portion of his address contained very valuable suggestions regarding the future of economic Entomology in India.

Of the 664 papers read at the eleven sections, the agricultural section claimed as many as 56 dealing with subjects such as agronomy; soils; fertilisers and manures; crop pests and diseases; statistical methods and agricultural meteorology. It is gratifying to note that Coimbatore was responsible for 12 papers. At the joint meetings of sections several subjects of agricultural interest were discussed the more important of which were (1) erosion and drainage problems in India (2) disease and pest resistance in crops (3) composts and (4) experimental field trials.

Disease and Pest resistance in Cultivated crops. Pests and diseases are the bane and the curse of the crop-grower and he will be naturally pleased to know how best to avoid them or overcome them. Time-honoured methods like dusts and sprays, though indispensable, seek to destroy the pests and give relief for the moment but do not attempt to prevent a recurrance. It augurs well therefore that today the pest and disease control problems are receiving a new line of approach which has for its object the minimum incidence of these diseases.

The present day tendency is to regard them more as the manifest symptoms of the unhealthy condition of the plant than as the true cause inducing such expression in the plant; when once the unhealthy condition is corrected or removed, the symptoms vanish by themselves. In a work of this kind factors leading to disease and pest resistance are being utilized in large measure with great success.

Resistance is of two kinds; genetic and acquired The plant breeders have not been slow to use the genetic resistance in evolving resistant strains. Coimbatore is famous for its mosaic-resistant canes ; Pusa for rust resistant wheats and Africa for its jassid-resistant cotton. But very unfortunately for us the genetic resistance often breaks down if the material is transferred to new geographical areas. And one has to be breeding types to suit particular localities. We know cases of break down are the jassid resistant cotton (11/4) in Coimbatore; mosaic resistant cane (Co. 205) in North India etc. It is hoped that the attempts of our Cotton Specialist to evolve Pempheres resistant strains of cotton will be successful.

Acquired or induced resistance is brought about by proper soil treatment. It is well known that addition of certain elements like boron, silica, potash and iron have helped to correct the deficiency diseases. Peach aphis at Quetta could be got over by soil aeration, leaf curl and red leaf diseases of American cotton are supposed to be the result of soil deterioration during rainy weather and addition of argarine matter to improve the soil is found to be the necessary corrective. Coconut shoot rot infection could be got over by soil dressing with potash sulphate and deep planting. The well known betel vine diseases are put down to the super-saturated condition of the soil which brought about a defective water balance for which good drainage is the corrective.

Howard has suggested that a fungus, *Mycorrhiza* growing at the root tips of plants is directly connected with the transport of the important nutrient material from the humus into the plant and the presence or absence of it would seem to determine the nature of resistance; this is a claim which has been disputed and no doubt experiments have to be made to test the truth of this statement.

It is hoped that with the increasing knowledge and with the helpful cooperation of the breeder, pathologist, and entomologist ways and means of augmenting disease and pest resistance in crops may be found.

Power Alcohol in Other Countries.

BY C. N. ACHARYA, M. Sc., Ph. D, A. I. C.
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Now that the question of power alcohol is attracting much attention in this country and several provincial governments have seriously taken on hand schemes for its manufacture and use as motor-fuel, it would be interesting to examine how much attention this problem has received in other countries and how far attempts in this direction have been successful there.

The phenomenal development of the petroleum industry in the closing decades of the nineteenth century was mainly due to the rapid increase in the use of internal combustion engines for transport on land, in sea and in air, also for driving machinery and generally wherever a small scale source of power is necessary. Though power obtained through such engines is costlier than that obtained from coal or hydro-electric energy, the internal combustion engine possesses such marked advantages, wherever an intermittent source of power, easily transportable from place to place, is necessary, that its use has been rapidly increasing during the last few decades. Its importance in armaments is doubly great, on account of its use in all machines of modern warfare, e. g. tanks, aeroplanes and even battleships. The importance of petroleum, both in peace and in war, is therefore evident.

Unfortunately, supplies of petroleum are confined to a few countries principally U. S A, Mexico, Russia, Rumania, Persia, Iraq and Burma. With the growth of militant nationalism in most countries, in recent years, and a policy of national self-sufficiency in important raw-products, attempts have been made from the beginning of this century to find local substitutes in each country for petroleum.

Countries which have been blessed with a plentiful supply of coal, e. g. England, and Germany, have spent huge sums of money in researches on the conversion of coal into petroleum hydrocarbons. Their efforts have been crowned with success, as shown by the development of low temperature hydrogenation process for the conversion of coal into petroleum products, though it is admitted that the oil obtained thereby is costlier than petroleum obtained at present.

Other countries, such as France, Italy, Austria, Poland, Sweden etc., which possess neither abundant coal nor petroleum supplies, but are endowed with rich agricultural potentialities, have made strenuous attempts to find out other satisfactory substitutes for petroleum. The most promising substitute they have found so far is ethyl alcohol.

Serious attempts to use ethyl alcohol in internal combustion engines were started as long ago as 1894[1], but the earlier attempts in this direction met only with partial success on account of the fact that before the Great War, 95% alcohol was the most concentrated product that could be obtained on a large scale at economic prices. The presence of the 5% of water in

the fuel possessed various defects such as difficulties in blending with gasoline, loss of calorific power, engine trouble etc., and thus set a limit to the usefulness of the fuel.

But after the War, (since 1922) large scale methods for the preparation of absolute alcohol (100%) were developed and improved to such an extent that, today, absolute alcohol on the bulk scale could be produced at about the same price (4 as. to 6 annas per gallon) as 95% alcohol. These processes (chiefly, Melle, Drawinol and Hiag) have revolutionized the power alcohol industry and have helped it to grow by leaps and bounds during the last ten years (Table II).

The use of anhydrous alcohol for fuel purposes has served to overcome most of the disadvantages which 95% alcohol formerly possessed, and has thus made alcohol a serious competitor to petrol.

The relative advantages and disadvantages of alcohol as against petrol as motor fuel have been discussed at various conferences of petroleum technologists and others, both in Europe and in America [2, 3, 4, 5]. On a theoretical basis, the chief disadvantage of alcohol has been stated to lie in its lower calorific power as compared with petrol, the relative values being 11,690 B. T. U. per lb. of alcohol and 16,800 B. T. U. per lb of petrol[5]. This, on theoretical considerations, would necessitate the consumption of a proportionately greater amount of alcohol than petrol in order to obtain the same output of energy. But this disadvantage is in actual practice, to a great extent counterbalanced by certain marked advantages of alcohol over petrol, e. g. (1) the smaller amount of air necessary for the complete combustion of alcohol, the volume of air required being 9 lbs. per lb. of alcohol, as against 15 lbs. required per lb. of petrol[5]; thus, under ordinary conditions, a more complete combustion of alcohol takes place in the engine than of petrol, with the liberation of a proportionately greater amount of energy in the former case; (2) the superior "anti-knock" value of alcohol; thus admixture of petrol with 20 % of alcohol is equivalent to adding 44 % of benzol[5], (3) the higher Octane number of alcohol (about 90) compared with that of gasoline (about 60 to 65); and (4) as a consequence of the above two properties, the alcohol engine can work at a higher compression value than a petrol engine, without knocking: the H. U. C. R. for alcohol is 7 to 8 while that for petrol[5] is 4·5 to 5. Since the increasing tendency at present is to manufacture engines of compression ratio 5 5 and higher, it is found in practice that the efficiency of an alcohol engine is much higher (25:15) than that of a petrol engine [4, 6]. This increased efficiency counterbalances the lower calorific value of alcohol; and thus, within certain broad limits, the actual output of work per gallon of fuel is found to be greater in the case of alcohol blends than on straight petrol [2, 3, 4]. Most modern racing engines, in fact, possess high compression ratios and are adapted to run on fuels which possess alcohol as the base.

The use of straight (unblended) alcohol, however, as fuel necessitates radical alterations of the present type of engines, whose compression ratios, carburettor adjustments and fuel-air ratios have been adapted to the use of

petrol. Such alterations, however, are unnecessary if a mixture of petrol with alcohol in suitable proportions be used, instead of pure alcohol. The preparation of such blends was subject to serious limitations, when 95% alcohol was in use, but these difficulties no longer exist now, since anhydrous alcohol is miscible with petrol in all proportions.

Various trials run in America and in Europe [2, 3, 4, 5] with different types of motor engines have shown that when the proportion of alcohol in the petrol-alcohol blend is below 30%, the mixed fuel can be used in the present type of engines in use, without any alterations (except possibly for a slight adjustment of the carburettor opening), and the blend gives the same and in several cases a higher mileage per gallon than straight petrol. Starting is easier and the anti-knock value of the blend is superior. The anti-calamine value of the blend is markedly improved. Reports of corrosion of the engine parts were found to be due to the denaturants used for alcohol, rather than to the alcohol itself.

Advantage was taken of these marked superiorities of the mixed fuel, by most of the European countries, in order (1) to serve their national and political interests by developing a source of power within their own boundaries which they could depend upon in times of war; and (2) to encourage their home grown agricultural products, by creating an additional market for them.

As, however, popular prejudice was intitially against the innovation, most of the European countries had to resort to legislation to enforce a compulsory mixing of petrol with alcohol in all motor fuels sold to the public. There are very few countries at present in Europe or America, outside the petroleum producing group, which have not passed such legislation; and it is not surprising that a similar move should be made in India also.

Sources of Power Alcohol. The economics of alcohol production from different sources have been dealt with in detail by Monior Williams (pp. 86 *et seq.*; vide also Nash & Howes, pp. 483 *et seq.*). Now that the price of petrol is fairly low, it is necessary that the cheapest source of alcohol should be resorted to, if alcohol is to compete with petrol, or if admixture of petrol with alcohol is not to increase the cost of motor fuel.

It is interesting to note the variety of sources from which Germany is deriving its alcohol production which amounted in 1936—37 to about 4 million hectoliters[7] (vide Table I).

TABLE I. Alcohol production in Germany.

Source	1935—36	1936—37
1. Potatoes	1,973,295 tons	2,022,558 tons.
2. Sulphite liquors	67,603,097 hl.	74,650,619 hl.
3. Molasses	199,797 tons	205,515 tons.
4. Stone fruit and Residues	425 612 hl.	205 443 hl.
5. Grape vine juice	189,240 hl.	246,295 hl.
6. General cereals	141.294 tons	63,172 tons.
7. Non-cereal products	419 866 hl.	335,537 hl.
8. Dry wood substance	11.371 tons	30,609 tons.
9. Brewery residues	1,183 hl.	1.643 hl.
10. Calcium carbide	419 tons	1,006 tons.
11. Wood sugar molasses	230 tons	1,301 tons.

The chief sources at present in Germany are potatoes (2·3 million hl. of alcohol) and sulphite waste liquors.

In addition to the above sources, mention should be made of cane molasses, which is the most promising source for India, juices of palms such as palmyra, coconut and Nipah, and several flowers and tubers rich in sugars or starch. Very favourable reports have been made of the potentialities of Nipah for this purpose[8]. Similar studies do not appear to have been made yet in India regarding the economics of alcohol production from the coconut and palmyra juices. Mhowra flowers *(Bassia latifolia, B. longifolia* and *B. butyracea)* are available in large quantities in the Central Provinces and in Hyderabad and would doubtless prove an attractive source for the preparation of alcohol[1] in that area. Charlton[9] recently examined the suitableness of broken rice (available in large quantities in Burma) as the raw material for the preparation of power alcohol and arrived at the conclusion that it was not a paying proposition.

The following paragraphs give an idea of the growth of the power alcohol industry in some of the principal countries of the world, and the scope of government legislation on the matter in those countries.

Germany. Germany was one of the earliest countries to tackle the problem of power alcohol, especially as she had a huge production of alcohol from potatoes and beet molasses, for which there was no ready market. It was at Leipzig that Hartmann[1] first started in 1894 large scale investigations on the suitability of alcohol as motor fuel, under the auspices of the Deutsche Landwirtchaftliche Gesellschaft These experiments were further extended by the "Centrale für Spiritus Verwertung" a co-operative organization of alcohol distillers.

Under the Spirit Monopoly Act of 1918, the State took over control of the production and distribution of alcohol throughout Germany. At the present time[2], there are two kinds of motor fuel used in Germany, one containing 11% of absolute alcohol and 89% of petrol, and the other containing about 3% of absolute alcohol, 3·5 to 5% of methanol, 35% of benzol and the rest petrol. Since June 1936, binary motor fuels contain in addition 20% of methanol.

France. Since the close of the War, France has been showing a keen interest in the utilization of alcohol for power purposes. It was in France that in 1922 the first satisfactory process for the manufacture of absolute alcohol (Melle process) was worked out on a large scale and put into commercial practice.

In October 1931, a decree was passed[5] compelling importers of gasoline and other products used as motor fuel, to add to such products 25–35% by volume of anhydrous alcohol (Heavy Carburant Nationale). This decree affected in the first instance only commercial vehicles plying for hire, such as lorries and trucks, but was soon followed by another decree passed on 14th November 1931, which compelled the addition of 10% by volume of

alcohol to all gasoline imported into the country irrespective of the kind of vehicle for which it was used.

England. England, not being an agricultural country, has devoted more attention to processes for the conversion of coal into petroleum products, rather than to the production and use of power alcohol. Still, the availability on the world market of cheap molasses from sugar producing countries, has tempted her to manufacture power alcohol on a large scale. Such production increased rapidly in recent years and was consumed mainly in the preparation of suitable blends with petrol. But this year Government have introduced a duty of 9 d. per gallon on alcohol so produced for power purposes ([10]).

The rapid growth of the power alcohol industry in Germany, France and England, in recent years, is shown in the following table:

TABLE II. Power alcohol production in some countries.

Year.	France[3].	Germany[2].	England[5].
	(gallons)	(gallons)	(gallons)
1929—30	7,716,000	5,175,000	15,000
1931—32	18 827,000	25,657,000	56,610
1933—34	54,388,000	45,823,000	391,014
1935—36	88,000,000	48,509,000	1,475 275
1936—37			2,925,000

Italy. A Government decree of December 9th, 1931 provided for the mixing of 99·6% ethyl alcohol with imported gasoline in the ratio of 1 : 4. Producers of domestic gasoline were not exempt from this law. A further decree of 7th November 1935 reserves the total production of alcohol from beet root and a proportion of alcohol from other raw materials for use as motor fuel. A mixture of alcohol and ether has recently been adopted for aeroplane engines.

Hungary. A decree of 1929 made it compulsory for all gasoline of sp. gr. 0·735 or over to be mixed with 20% by volume of alcohol. The alcohol—gasoline mixture is marketed under the name of "Motalko". The power alcohol industry is controlled in Hungary by a monopoly known as the National Alcohol Trading Company.

Sweden. Waste sulphite liquor, from paper mills, is the important source of alcohol in this country. In 1931, 79,260 barrels of alcohol were produced from the above source of which 48,000 barrels were used as motor fuel, mixed with gasoline under the trade name of "Lattbentyl" (75% of gasoline with 25% of alcohol). By the law of October 1, 1934, importers and producers of gasoline were compelled to purchase alcohol at the rate of 3·6% of the total volume of gasoline imported or produced.

Yugoslavia. Under regulations issued by the Minister of Finance on 29th September 1932, all motor fuels having a density less than 0·795 at 15°C, were compelled to be mixed with 25% by weight of alcohol. By a

further decree, which became effective on 1st December 1932, motorists in Yugoslavia are forbidden to drive motor vehicles on any fuel other than this alcohol blend[5].

Other European Countries. Legislation for the compulsory blending of gasoline with alcohol have also been passed in Austria, Czechoslovakia, Latvia, Spain, Bulgaria, Finland, Lithuania and Poland. Among the countries which have not yet made such compulsory legislation may be mentioned England, Holland, Norway, Portugal, Greece and Rumania.

The growing importance of alcohol in motor fuels is shown by the following figures taken for the year 1935 :—

TABLE III. Use of Alcohol fuels in European countries.[5]

Country.	Metric tons consumed.	Price of alcohol cents per gallon.	Number of motor vehicles.	Cost per motor vehicle U. S.	Total cost of alcohol fuel to country.
1. Austria	4,400	57	45,000	17,50	793,000
2. Czechoslovakia	42,477	76	90,000	61 66	5,549,800
3. France	293,600	27	2,182,000	35,50	77,529,000
4. Germany	180,000	76	1,104,000	55,87	61,688,000
5. Hungary	8,731	79	15,200	136,30	2,072,000
6. Italy	5,000	88	392,000	4 00	1,577,000
7. Jugoslavia	6,592	40	10,400	21,83	227,000
8. Latvia	5,457	59	3,950	356,00	1,408,000
9. Poland	5,941	19	25,200	33 73	851,000
10. Spain	12,000	52	179,500	1 13	204,000
11. Sweden	12,250	31	154,800	6,37	986,000
Total	576,448		4,202 050		152,884,000

South Africa. Among the non-European countries, South Africa began to take a keen interest in the power alcohol question some 20 years ago. The Natal Cane By-Products Ltd , first marketed in 1917 a motor fuel known as "Natalite", which consisted of 60% of ethyl alcohol and 40% of ethyl ether. When prices of petrol rapidly fell in the post-war period, the above Company marketed a mixture of equal parts of Natalite and gasoline under the name of "Union Motor Spirit". At that time, however, the alcohol used was 94—95% only and this gave rise to some engine trouble especially with die-cast zinc carburettors and the metal tops of auto-vac tanks. But after the installation of modern processes (Melle) for the preparation of absolute alcohol, the above troubles have disappeared. The Government of the Union of South Africa, with a view to encourage the use of alcohol-blended motor spirit allowed a rebate of the whole duty payable on gasoline (6 d. per gallon) in proportion to the alcohol contained in the fuel. This rebate has since been reduced to 3d. per gallon[5].

Among the American countries, Brazil, Chile, Cuba, Philippines, Panama, Salvador, etc. have also passed regulations in favour of petrol-alcohol blends.

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Grass Flora of the Chittoor District with special reference to Fodder Grasses.

BY K CHERIAN JACOB, L. Ag., F. L. S.

The growth of grasses depends on the amount of rain received. Four to five inches of rain received in four or five showers spread over ten to fifteen days is the minimum rainfall required for the grasses to grow and set seed. There was a rainfall of 12 inches in September 1938 in the Chittoor District and as many as 56 species of grasses were in flower in October 1938. Of these about 40 are of good fodder value.

Even though the species of grasses found in the various districts of the Presidency do not vary much, the predominance of a few good fodder grasses in given areas makes those places suitable for cattle-rearing. For example, the predominance of *Kolukkattai* grass (*Cenchrus ciliaris*, Linn.) in the Kangayam tract of Coimbatore District contributes to a large extent to the success of the famous Kangayam breed of cattle of that district and similarly *Cheng. li Gaddi* (*Iseilema laxum*, Hack.) to the Ongole breed of cattle of Nellore District. Both these well-known fodder grasses are absent in the Chittoor District and one step towards the solution of the fodder problem of this district may lie in the introduction of these two important grasses into this district. It is thus essential that a grass survey of the various districts of the Presidency should be made at the outset. It is only after taking stock of the fodder grasses of given areas that any suggestion regarding the solution of the grazing problem can be made.

Grasses may be either annuals or perennials. In tropical countries especially in South India many species of annuals appear with the commencement of the monsoon and die out in summer after setting seed, while the perennials survive the summer, even though the shoots may dry up and

break off. The annuals require a good deal of moisture and fertility in the soil and in the absence of the optimum quantity of these, they slowly give place to the perennials.

In the Hosur Cattle Breeding Station, Salem District, hay is stacked in paddocks of pure growth of *Heteropogon contortus*, Beauv. (Spear grass) but when the hay stack is removed, annuals such as *Brachiaria ramosa* Stapf. (*Panicum ramosum*, Linn.), *Urochloa panicoides*, Beauv. (*Panicum javanicum*, Hook.), *Urochloa reptans* Stapf. (*Panicum prostratum*, Lamk.), *Echinochloa colona*, Link. (*Panicum colonum*, Linn.), *Setaria intermedia*, R. & S., *Dactyloctenium aegyptium*, Beauv. (*Eleusine aegyptiaca*, Desf.) *Eragrostis cilianensis*, Link. (*Eragrostis major*, Host.), etc., grow in places where the hay was stacked, surrounded by the common grass of the paddock, the Spear grass. The growth of these annuals is due to the accumulated organic manure derived from the hay stack. These annuals give place to perennials like *Amphilophis pertusa*, Stapf., *Digitaria marginata*, Link., var. *fimbriata*, Stapf., etc., in the course of the next one or two years; and as the fertility decreases the hardy Spear grass, which can subsist on the minimum moisture and plant food once again takes possession of the field ousting the less hardy perennials. In the forests where spear grass is predominating, *Amphilophis pertusa*, Stapf. (*Andropogon pertusus*, Willd.) is seen on old white-ant mounts in the midst of the Spear grass. This indicates that the hardy species of grasses establish themselves, replacing the less hardy ones as the fertility of the soil decreases.

A good fodder grass should be perennial in habit and should stand cuttings, with a good growth of vegetative parts without any of the defensive weapons, such as, rough hairs, strong odour, penetrating awns or barbs, lignified tissue and the like.

The importance of the trailing leguminous plants like the species of *Alysicarpus*, etc., in pastures cannot be underestimated. These take the place of clover in the pastures of European countries. Leguminous plants like these not only afford good fodder for cattle but also fix the atmospheric nitrogen into the soil thereby enriching it. It is therefore necessary to encourage the growth of leguminous plants in pastures.

The grasses of the district may be roughly classified into 3 groups, viz., the pasture grasses, grass weeds in standing crops and the forest or hill grasses. The cattle belonging to the ryots of this district depend for their fodder on all the above 3 groups of grasses.

The important grasses of the pastures are :—

Amphilophis pertusa, Stapf. *Digitaria marginata*. Link. var., *fimbriata*, Stapf. *Brachiaria distachya*, Stapf. *Brachiaria eruciformis*, Griseb. *Brachiaria ramosa*, Stapf. *Paspalidium flavidum*, A. Camus. *Urochloa reptans*. Stapf *Urochloa panicoides*. Beauv. *Echinochloa colona*, Link. *Setaria pallidifusca*, Stapf. et. Hubbard.

Aristida depressa, Retz. *Tragusibiflorus*, Schult. *Sporobolus diander*, Beauv. *Sporobolus coromandelianus*, Kunth. *Eragrostis plumosa*, Link. *Oropetium Thomaeum*, Trin. *Cynodon Dactylon*, Pers. *Cynodon Barberi*, Rang. & Tad. *Chloris barbata*, Sw. *Dactyloctenium aegyptium*, Beauv.

All the above species of grasses except *Aristida depressa*, Retz, *Oropetium Thomaeum*, Trin., *Sporobolus diander*, Beauv, and *Sporobolus coromandelianus*, Kunth. are good fodder grasses.

The grasses growing in standing crops as weeds generally attain their maximum growth and luxuriance. The following are the important grasses in the standing crops :—

Amphilophis pertusa, Stapf. *Digitaria marginata*, Link var., *fimbriata*, Stapf. *Alloteropsis cimicina*, Stapf. *Brachiaria distachya*, Stapf. *Brachiaria ramosa*, Stapf. *Paspalidium flavidum*. A. Camus. *Urochloa reptans*, Stapf. *Urochloa panicoides* Beauv. *Echinochloa colona*, Link. *Panicum repens*, Linn. *Setaria pallidifusca*, Stapf et Hubbard. *Setaria intermedia*, R. & S. *Aristida depressa*, Retz. *Tragus muricata*, Steud. *Tragus biflorus*, Schult. *Sporobolus diander*, Beauv. *Eragrostis ciliancnsis*, Link *Eragrostis pilosa*, Beauv. *Cynodon Dactylon*, Pers. *Cynodon Barberi*, Rang. & Tad. *Chloris barbata*, Sw. *Dactyloctenium aegyptium* Beauv.

All the above grasses except *Aristida depressa*, Retz. and *Sporobolus diander*, Beauv. are good fodder grasses. The cut grasses sold in head-loads as fodder in this district consist mainly of the above species.

The important forest or hill grasses are :—

Sehima nervosum, Stapf. *Lophopogon tridentatus*, Hack. *Amphilophis pertusa*, Stapf. *Chrysopogon montanus*, Trin. *Heteropogon contortus*, Beauv. *Themeda triandra*, Forsk. *Iseilema prostratum*, Anderss. *Apluda aristata*, Linn. *Eremopogon foveolatus*, Stapf. *Cymbopogon flexuosus* Wats. *Cymbopogon coloratus*, Stapf. *Cymbopogon Martini*, Wats. *Cymbopogon Gidarba*, Haines. *Hackelochloa granularis*, O. Ktz. *Mnesithea laevis*, Kunth. *Digitaria marginata*, Link, *var*., *fimbriata*, Stapf. *Digitaria longiflora*, Pers. *Alloteropsis cimicina*, Stapf. *Brachiaria distachya*, Stapf *Brachiaria cruciformis*, Griseb. *Brachiaria ramosa*, Stapf. *Panicum trypheron*, Schult. *Cyrtococcum trigonum*, A Camus. *Setaria pallidifusca*, Stapf. et Hubbard *Setaria intermedia*, R. & S. *Setaria verticillata*, Beauv. *Arundinella setosa*. Trin. *Aristida depressa*, Retz *Aristida setacea*, Retz. *Aristida Hystrix*, Linn. *Tragus biflorus*, Schult. *Perotis indica*, O. Ktz. *Sporobolus diander*, Beauv. *Eragrostis spicata*, Jedwabn. *Eragrostis riparia*, Nees. *Eragrostis plumosa*, Link. *Eragrostis tenuifolia*, Hochst. *Eragrostis pilosa*, Beauv, *Eragrostis bifaria*, Wt. *Eragrostis brachyphylla*, Stapf. *Oropetium Thomaeum*, Trin. *Cynodon Dactylon*, Pers. *Cynodon Barberi*, Rang. & Tad. *Chloris barbata*, Sw *Dactyloctenium aegyptium*, Beauv.

Sehima nervosum, Stapf. (Tel: *Nendra Gaddi*), the most important of the hill grasses is very common in all the forest regions of this District. *Cymbopogon Gidarba*, Haines. (Tel: *Adavi Kanchi*), another important fodder grass is also found in many parts of these forests. A good majority of the above mentioned grasses except *Aristida depressa*, Retz., *Aristida setacea* Retz, *Aristida Hystrix* Linn. *Arundinella setosa*, Trin, *Oropetium Thomaeum*, Trin., *Cymbopogon coloratus*, Stapf. *Cymbopogon Martini* Wats, *Cymbopogon flexuosus*, Wats., *Mnesithea laevis*, Kunth. *Themeda triandra*, Forsk, and *Setaria verticillata* Beauv. are good fodder grasses, A good part of the forest revenue of this District is derived from grazing permits issued to cattle owners. The forest grazing can be improved

by rotational system of grazing and by growing *Sehima nervosum,* Stapf. (Tel: *Nendra Gaddi*) wherever it is absent and by the introduction of *Iseilema laxum,* Hack. (Tel: *Chengali Gaddi*); *Cenchrus ciliaris,* Linn. (Tam: *Kolukkattai Pullu*) and *Chionachne Koenigii,* Thw. (Tel: *Gela Gaddi*) from other districts.

Albizzia amara, Boiv. (Tel: *Nalla Renga*; Tam: *Wunja*), a very common leguminous tree found especially in the forests of this district affords a valuable fodder for cattle. This forage plant supplements the fodder grasses of this district. It is therefore suggested that forage plants like the above may be grown in village porambokes, unreserved forests and also in non-remunerative reserved forests to supplement the fodder grasses.

A full list of the grasses of the Chittoor District with short notes and local names wherever available is given below. Old botanical names are given within brackets along with the new names wherever there have been changes, since most of the readers of this Journal may be familiar with the old names.

1. *Sehima nervosum,* Stapf. (*Ischaemum laxum,* R. Br.)

Tel: Nendra Gaddi; Neradi Kasuvu. Kan: Nalai hullu.

It is the best of the hill fodder grasses It grows in very large clumps putting forth probably the largest number of tillers in any of the Indian grasses. It grows to 2'—3' in height and stands cuttings well. It is rather difficult to get this grass established in a new locality. Cattle improve rapidly when they graze this grass. It is found in all the reserved forests of this District.

2. *Lophopogon tridentatus,* Hack.

It grows to 1'—1½' in height. It thrives in very dry localities in the scrub jungles and is not considered a good fodder grass. Cattle, however, nibble it before flowering.

3. *Amphilophis pertusa,* Stapf. (*Andropogon pertusus,* Willd.) Tel: Kanthalam; Genjulu Geruge. Kan: Karai Kanda Hullu. Tam: Chinna Karai Pullu.

It is very common throughout the Presidency and is one of the best pasture grasses. It covers the ground by its slender creeping stems. Though the output of forage is rather small, it is considered one of the good fodder grasses. When fertility of the soil diminishes, it is ousted by *Heteropogon contortus,* Beauv. (Spear Grass)

4. *Amphilophis pseudoischaemum,* C. E. C. Fischer n. comb. (*Andropogon pseudoischaemum,* Nees)

Tel: Neetiyeedava.

It is a very rare grass growing to 5' in height. It is a good fodder grass.

5. *Chrysopogon montanus,* Trin. (*Andropogon monticola,* Schult.)

Tel: Gurra Batto Kelu; Nakka Baroganta.

It is a common grass of the scrub jungles growing to 1½′ in height. It is gregarious in habit and is easily made out even from a distance on account of its gold coloured inflorescence. Cattle graze this grass but do not relish it much after flowering. The output of forage is small.

6. *Heteropogon contortus*, Beauv. (*Andropogon contortus*, Linn.)

Eng: The Spear Grass. Tam: Oosi Pullu. Tel: Pandi Oopa: Pandu Mullu Gaddi Kan: Sunkari Hullu.

It is the commonest grass in all the forest areas of this Presidency. It is a hardy grass growing to 2′ in height and is much relished by cattle before flowering. Cattle graze it also after the awns drop off. It ousts all other grasses in poor and rocky soils. It makes excellent hay and silage if cut before or at the time of flowering.

7. *Themeda triandra*, Forsk. (*Anthistiria imberbis*, Retz.)

Tel: Pedda Yerra Kalla Kasuvu. Tam: Erigai Thattu Pullu.

It grows to 4′ in height and is used for thatching. Cattle nibble this grass when young. It occurs in all the forest areas.

8. *Iseilema prostratum*, Anderss. (*Iseilema Wightii*, Anderss.)

Tel: Yerra Kala Kasuvu.

It is a rare grass growing to 1½′—2′ in height and is an excellent fodder.

9. *Apluda aristata*, Linn. (*Apluda varia*, Hack. subsp. *aristata*, Hack.)

Tel: Burra Kanchi. Kan: Akku Hullu. Tam: Manda Pullu.

It is a common hill grass growing to 4′—5′ in height and rooting from the basal nodes. It is a good fodder grass readily eaten by cattle before flowering. There is a tendency for the stems to break off after the spikes mature. There is a slender and a robust form in this species.

10. *Eremopogon foveolatus*, Stapf. (*Andropogon foveolatus*, Del.)

It is a common grass met with in the hills and plains. It grows to 1½′—2′ in height. It is one of the best fodder grasses. The yield of fodder is not high because of the slender habit of the plant.

11. *Cymbopogon flexuosus*, Wats. (*Andropogon Nardus*, Linn. var. *flexuosus*, Hack.)

Eng: The Malabar Lemon Grass; the Ginger Grass. Kan: Anthi Balai Tam: Sukkunari Pullu.

This hill grass grows to 6′--8′ in height. The stem will be often as thick as the little finger. It is cultivated extensively especially in Travancore and Cochin for the extraction of the essential oil "Malabar Lemon-grass oil". This grass is also used for thatching purposes. It is unfit as a fodder grass because of its strong odour. There is a white and a purplish form in this species.

12. *Cymbopogon coloratus*, Stapf. (*Andropogon Nardus*, Linn., var. *coloratus*, Hook. *f.*)

Tel: Bodha.

It grows to 2'—3' in height and is confined to the scrub jungles. It is used for thatching. It is not grazed by cattle because of the strong odour it possesses.

13. *Cymbopogon Martini*, Wats. (*Andropogon Schoenanthus*, Linn. var., *Martini*, Hook f.)

Tel : Kanchi ; Kasi Gaddi. Kan : Kasi Hullu. Tam : Kavattan Pullu.

It grows to 4'—5' high occurring mostly in hills and sometimes in waste places. It is sometimes cultivated for the essential oil it contains. The oil extracted is commercially known as "Geranium oil" or "Rusa oil". It is not touched by cattle because of its strong odour. This grass is also used for thatching.

14. *Cymbopogon Gidarba* Haines.

Tel : Adavi Kanchi :

This hill grass grows to 3' - 4' high. This is the only Madras species of *Cymbopogon* which possesses no odour. It is a very good fodder grass. A white and a purplish form occur. This grass should be introduced into localities where it is absent.

15. *Hackelachloa granularis*, O. Ktz. (*Manisuris granularis*, L.)

Tel : Uppu Ganta Kasuvu ; Kuru Jedanai Gaddi. Kan : Kadu Sanna Harka Hullu.

It is a rare grass growing to 1½' in height. It is moderately a good fodder.

16. *Mnesithea laevis*, Kunth. (*Rottboellia perforata*, Roxb.)

Tel : Koriki , Panuku. Kan : Sunku Dabbai Hullu.

It grows to 3'—4' in height in the bed of hill streams. It is not grazed by cattle, except when the plants are very young.

17. *Digitaria marginata*, Link., var. *fimbriata*, Stapf.

Eng : Crab grass. Tel : Peddootla Gaddi. Kan : Henna Akkibu Hullu. Tam : Arisi Pullu.

It is a common grass found everywhere. It grows to 1½'—2' in height with a spreading habit. It is one of the best fodder grasses. Being a slender grass, the quantity of forage produced is not much.

18. *Digitaria longiflora*, Pers. (*Pasapalum longiflorum*, Retz.)

Tel : Pora Kasuvu ; Pakuru Gaddi. Kan : Tapari Hullu.

It is a slender grass growing to 1½' in height. It occurs mainly in forest tracts. It is a good fodder grass.

19. *Alloteropsis cimicina*, Stapf. (*Axonopus cimicinus*, Beauv.)

Tel : Borrapala Gaddi. Kan : Neru Sajjai Hullu.

It is an annual growing to 2' in height Cattle readily graze this grass. It is not considered a good fodder grass on account of the low yield of forage and its annual habit. It is a common grass found both in arable lands and forest regions.

20. *Brachiaria distachya*, Stapf. (*Panicum distachyum*, Linn.

Tel: Koranna Gaddi. Kan: Hambu Haraka Hullu.

It is a common pasture grass spreading on the ground. It does not thrive in dry situations. Cattle graze it readily but the fodder produced is not much.

21. *Brachiaria eruciformis*, Griseb. (*Panicum Isachine*. Roth.)

Tel: Edira Kasuvu; Domakalu Gaddi.

It is a slender grass growing to 1½' height. It thrives in black cotton soils. Cattle graze it readily but the quantity of forage produced is not much.

22. *Brachiaria ramosa*, Stapf. (*Panicum ramosum*, Linn)

Tel: Eduri Gaddi. Kan: Kadu Baragu Hullu.

It is an annual growing to 2' in height It is chiefly met with as a weed in standing crops. Cattle graze this readily. It does not thrive in dry situations. It is cultivated by Muhammadans near Vizagapatam town for the grain which is used for making bread.

23. *Paspalidium flavidum*, A. Camus. (*Panicum flavidum*, Retz.)

It is a spreading annual. It thrives in moist situations and is one of the best pasture grasses of this district. Cattle relish it well.

24. *Urochloa panicoides*, Beauv. (*Panicum javanicum*, Hook.)

Tel: Salla Wudu. Kan: Kadu Billi Samai Hullu.

It is also a spreading annual thriving in moist situations. It is one of the pasture grasses of this district. Cattle relish this well.

25. *Urochloa reptans*. Stapf (*Panicum prostratum*, Lamk.)

Tam: Shani Pullu.

It is an annual thriving in moist situations. It is one of the pasture grasses with a spreading habit. The quantity of forage produced is not much. The grain is said to be eaten by the poor in times of scarcity.

26. *Echinochloa*, Link. (*Panicum colonum*, Link.)

Tel: Otha Gaddi; Kaproda Gaddi. Tam: Karum Pul; Varsanum Pullu.

It grows to 1½' in height and is decumbent. It is an annual, thriving only in moist situations. It is relished by cattle. Grain is said to be eaten by the poor.

27. *Panicum trypheron*, Schult.

Tel: Adavi Satha Gaddi. Kan: Kadu Karai Samai Hullu. Tam: Samai-karunai.

It is an annual growing to 2' in height. It occurs largely in the forests and is relished well by cattle.

28. *Panicum repens*, Linn.

Tel: Lada Gaddi; Kari Gaddi. Kan: Sonti Hullu. Tam: Inji Pullu; Tinei Pullu.

It grows to 1½' in height thriving in wet situations. It is found chiefly on the bunds of paddy fields. It is much liked by cattle and is said to stimulate the yield of milk.

29. *Cyrtococcum trigonum*, A. Camus. (*Panicum trigonum*, Retz.)
Kan: Abbu Karkai.

It is a spreading grass occurring in the forests under shade. It is relished by cattle but the quantity of forage produced is very little.

30. *Setaria pallidifusca*, Stapf et Hubb (*Setaria glauca*, Beauv.)
Tel: Nakka Kora; Kuradakori Gaddi.

It is an annual growing to 1½' in height and thriving in moist situations. Cattle graze it readily. The grain is said to be eaten by poor class of people.

31. *Setaria intermedia*, R & S.
Tel: Arranki Gaddi. Kan: Dodda Anta Purlai Hullu.

It grows to 1½' in height thriving in moist and shady places. It is relished by cattle but not considered a good fodder grass on account of its annual habit.

32. *Setaria verticillata*, Beauv.
Tel: Chik Lenta; Aranta. Kan: Sanna Anta Purlai Hullu.

It is an annual often rambling on bushes in hedges. It grows to 3' in height. Cattle graze it before the spikes appear but it is not touched by them after the spikes appear on account of the reversed barbs on the bristles of the involucre.

33. *Arundinella setosa*, Nees.
Tel: Pathi Oopa Gaddi; Chappadi Kasuvu. Kan: Hakki Varji Hullu; Maraga Thattu Hullu.

It grows to 3' in height and is confined mainly to the forest regions. It is not relished by cattle.

34. *Aristida depressa*, Retz. (*Aristida adscencionis*, Linn.)
Kan: Kari Sanna Hanchi Hullu. Tam: Kodai Balla Pullu.

It grows to 1½' in height. It occurs in the plains and hills. It is not a fodder grass.

35. *Aristida setacea*, Retz.
Tel: Paraka Gaddi. Kan: Dodda Hanchi Hullu. Tam: Thudappam Pullu.

It grows to 2' - 3' in height and is found in all the dry forest regions. It is used for making brooms. It is not grazed by cattle.

36. *Trachys muricata*, Steud. (*Trachys mucronata*, Pers.)

This annual grows to 1½' in height and is procumbent. It is a rare grass found as weed in standing crops. Cattle graze this readily.

37. *Tragus biflorus*, Schult. (*Tragus racemosus*, Hook f.)
Tam: Ottu Pullu.

It is a low spreading grass growing to 3"—8" high. It is not readily eaten by cattle because of the spiny spikelets sticking to their mouth-parts. It thrives in dry and sandy localities.

38. *Perotis indica*, O. Ktz. (*Perotis latifolia*, Ait.)
Tel: Boosra Gaddi; Nakka Toka. Kan: Nari Meesai Hullu. Tam: Narival Pullu; Kudirai-val Pullu.

It is a very slender grass growing to 1' – 1½' high. The leaves are few and are close to the ground; hence not considered a good fodder grass. It thrives in sea-shore sands and dry places.

39. *Sporobolus diander,* Beauv.

Kan : Navalu Dondi Hullu.

It grows to $1\frac{1}{2}'$ in height and thrives in shady places. It is grazed by cattle, but the fodder produced is not much.

40 *Sporobolus Wallichii,* Munro ex Hook f.

Tel : Konda Paraka.

It grows to 2′ in height and thrives in shady situations. The leaves are confined to the basal portion. It is grazed by cattle.

41. *Sporobolus coromandelianus,* Kunth.

Kan : Nari Balada Hennu Hullu.

It grows to 1′ high and is a common grass of the pastures. It is a poor fodder.

42. *Eragrostis spicata,* Jedwabn.

Kan : Kadu Nawanai Hullu.

It grows to 1′ high and is a rare grass. Cattle graze this.

43. *Fragrostis riparia,* Nees. (*Eragrostis tenella,* Roem. *et Sch. var. riparia,* Stapf.

Kan : Kadu Kambu Hullu.

It is slender grass growing to 1½′ high. It is found in the hills and plains. It is a good fodder grass but the quantity of forage is not much.

44. *Eragrostis plumosa,* Link. (*Eragrostis tenella,* Roem. *et Sch. var. plumosa,* Stapf.

Tel : Chinna Garikai Gaddi Kan : Sanna Purlai Hullu.

It grows to 1′ high and is often seen in patches. It is a slender grass grazed by cattle

45. *Eragrostis cilianensis,* Link. (*Eragrostis major,* Host.)

Kan : Bettada Akabu Hullu.

It is an annual growing to 2′ in height, often found as weeds of culivation. It is a rare grass readily eaten by cattle

46. *Eragrostis tenuifolia,* Hochst.

Kan : Thodda Karakai Hullu.

It grows to 1½′ in height and is often found in the forest regions under shade. It is grazed by cattle but the fodder produced is not much.

47. *Eragrostis pilosa,* Beauv.

Kan : Kadu Sanna Samai Hullu.

It grows to 2′ in height, often seen as a weed in standing crops. In some localities it is said to be much liked by cattle; elsewhere reported to be rejected by them.

48. *Eragrostis bifaria,* Wt.

Tel : Nakka Piththu Kasuvu ; Gubbikal Gaddi. Kan : Kodi Mara Hullu ; Nosai Hullu.

It is a slender grass growing to 1½′ high. It occurs mostly in dry and poor soils in the forests. Cattle graze this readily but the quantity of forage is not much, the leaves being minute and the stems slender.

49. *Eragrostis brachyphylla*, Stapf.

Tel : Nakka Piththu Kasuvu.

The habit and the characteristics of this grass are similar to those of *Eragrostis bifaria*, Wt.

50. *Oropetium Thomaeum*, Trin.

It is a dwarf grass growing to about 3" in height forming tussocks. It occurs in dry localities. The spikes are longer than the stems. It is too short for cattle to graze.

51. *Enteropogen monostachyos*, K. Schum. *(Enteropogon melicoides*, Nees.)

Tam : Kannai Pullu.

It is a tall grass growing to 3' in height. It thrives in dry forest regions. It is easily grown in the plains. It is found on analysis that it has very high nutritive value. It is one of the good fodder grasses giving an aggregate acre yield of 17,840 lbs. of green fodder in three cuttings at the Central Farm, Coimbatore. This grass should be introduced into forest regions where it is absent.

52. *Cynodon Dactylon*, Pers. (The common Hariali)

Tel : Gericha Geddi. Kan : Kudi Garikai. Tam : Arugam Pullu.

It grows to 1' high and is one of the best pasture grasses. It makes excellent lawns. The fodder is much relished by horses. It spreads by underground stems. It is a pernicious weed in arable land and is eradicated at great expense.

53. *Cynodon Barberi*, Rang. & Tad.

Tel : Sanna Ootla Kasuvu. Kan : Mel Garika Hullu.

It grows to 9" high and is one of the chief pasture grasses of this district. The fodder is much relished by cattle, and is often mistaken for "Hariali" from which it differs mainly in the absence of underground stems.

54. *Chloris incompleta*, Roth.

Tel : Kanthari Gaddi. Kan : Melamalai Hullu.

It grows to 1½' in height and occurs under shade in the forests. It is not considered a good fodder grass; however cattle nible it before flowering.

55 *Chloris barbata*, Sw.

Tel : Uppu Gaddi. Kan : Hennu Manchada Kalu Hullu. Tam : Kuruttu Pullu.

It grows to 1½' in height and is found everywhere except in dry and rocky soils. It is good fodder grass. It is one of the few grasses that thrives in alkaline soils.

56. *Dactyloctenium aegyptium*, Beauv. (*Eleusine aegyptiaca*, Desf.)

It is an annual creeping on the ground and rooting at the basal nodes. It is a common grass mainly found in the pastures and in standing crops. It does not thrive in dry and rocky soils. Cattle graze this readily.

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Fungus diseases – How they affect the wealth of the Madras Presidency.*

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Freedom from diseases is a *sine qua non* in the culture of plants. Each crop is susceptible to a particular disease or diseases. In our Presidency losses of different crops caused by diseases have not been determined with any degree of accuracy. Estimates made, go to show that they vary from 15 to 90% per year.

In most countries measures are taken to investigate diseases as they appear and to eradicate them or prevent their spread. These diseases are of various kinds differing in virulence, method of spread and response to control methods. To combat diseases a huge army of workers has become necessary and legislation has been resorted to in certain cases to reduce the incidence even if total extermination has not been possible.

Measures adopted have varied from country to country and the degree of perfection reached depends on the personal efficiency of the staff. International cooperation is necessary as otherwise minor diseases of one country may develop into serious ones when introduced into another. There are however limitations to our exertions in this respect as the spores of certain fungi are carried over long distances and great heights and thus pass from one country to another. Mehta has shown that in the case of the rust of wheat, spores are carried by wind from the hills to the plains of India.

Biological control is one of most promising lines of attack of the problem. Other steps that are necessary in this direction are :—

(a) Plant disease surveys
(b) Intensive study of diseases
(c) Issue of health certificates
(d) Port Inspection and Quarantine
(e) Insurance (Crop)
and (f) Legislation.

Each of these has definite limitations. Plant disease surveys provide reliable data of the distribution and periodicity of diseases in a country and this information can be made use of by the farmer to adopt control measures if there are any, in time. A knowledge of the causal organism, varieties of crop plants affected and how the organism continues from year to year and such other important data can be gained only by an intensive study of the diseases. This knowledge is essential to devise measures of control. A system of issuing health certificate over the signature of an authorised agent

*** Summary of the Curzon lecture delivered at the Agr. College, Coimbatore under the auspices of the Madras University.**

of the country of export has come into vogue. It has its own defects but it is a rough and ready method of keeping out diseases If this is coupled with a system of inspection at the port of entry and keeping in quarantine suspicious articles, it might be possible to check introduction of new diseases with the host plants imported This may be costly to the importer and may involve administrative difficulties. Crop insurance is likely to prove beneficial to the grower, but has not been seriously suggested or taken up and may be difficult of adoption Legislation can deal with various aspects from the time of sowing the crop plants till the products reach the consumer but its success depends upon several factors like the literacy of the cultivator, the cooperation of other agencies and the sympathetic handling of the administrator.

Next I shall take the various crops of the presidency and their common diseases.

Paddy. By far the most serious disease of paddy in this presidency is "blast" caused by *Piricularia oryzae*. It has been recorded from all rice growing countries of the world and in Madras it was first reported in 1918 from Tanjore The outbreak of the disease is linked up with the weather conditions prevailing during the cropping period of paddy. A warm humid atmosphere helps the development and rapid spread of the disease. The disease starts as brown spots in the leaves and under favourable conditions the whole earhead gets chaffy or the neck of the earhead breaks. The loss is more if the attack is early and less if it is late On the Central Agricultural Station, Coimbatore, the loss due to this disease on Korangusamba in the year 1927 ranged from 70 to 90%. Spores of the fungus are viable up to a period of 6 months and this is sufficient to bridge over the off season. The mycelium is present in all parts of the plant Besides paddy this fungus infects wheat, barley and oats

The disease is not amenable to direct treatment. Excess of nitrogenous manure predisposes the plants to this disease. Different varieties of paddy vary in their susceptibility to this disease and the chief venue of disease control therefore lies in the utilisation of disease resistant varieties.

Helminthosporium oryzae is not a very severe parasite on paddy and attacks the plant when in a weakened condition Small brown spots form on the leaves, and the nodes, neck and grains blacken Earheads may not emerge Disinfection of seed, destruction of infected stubble and clean cultivation reduce the amount of loss.

The foot-rot of paddy causes heavy damage to seedlings. The stalks elongate, large numbers of adventitious roots spring from the lower nodes and the earheads if formed become chaffy. Steeping seed in copper sulphate solution or dusting with ceresan has given beneficial results.

Another minor ailment is the sclerotial disease, which causes the formation of numerous green shoots at the base which turn yellow and die.

Empty glumes and poor development of grains result This may be controlled by growing disease resistant strains, removal of infected plants and thin planting of seedlings.

Cholam. Smuts, rusts and leaf shredding disease are the important diseases of this crop.

Short-smut. Affected grain is bigger than the normal grain, is covered by a light brown skin and is filled with a black powder. The damage is considerable.

Remedies. Treat the seed. Steep the seed in copper sulphate solution or subject it to a treatment with very fine sulphur.

On other cereals and pulses, little work has been done so far.

Chillies. Die-back and fruit-rot.

Leaves of young plants fall off. Young branches die back and are bare of leaves. Small black spots are seen on fruits when rotten.

Remedies. Spray early in the season. After harvest remove all plants in a diseased field and burn. Do not plant again for another two seasons. Do not use infected seed and avoid solanaceous crops.

Ginger. This is an important commercial crop which suffers fron leaf-spot disease and soft-rot.

Leaf-spot. Light yellow spots occur on both surfaces of leaves, and the portions affected dry up, forming holes. Some times entire leaf is attacked.

Remedies A spraying or two as necessary and using healthy rhizomes.

Soft-rot. Paleness of leaves of the shoot followed by yellowing of the tips of leaves. Sudden withering of leaves and shoot and rotting of rhizome.

Remedies. Reject diseased rhizomes.

Turmeric is chiefly grown in Guntur, Cuddapah, Vizagapatam and Coimbatore and suffers from leaf-spot and rhizome rot. Yellow spots form on leaves which increase in size and dry up. In the dried up portions of leaves small black spots appear. Later the infection spreads to the rhizomes.

Remedies. Spray with Bordeaux mixture in the early stages of attack. Secure healthy seed for sowing.

Betelvine. It suffers from wilt caused by the fungi *Phytophthora parasitica* and *Sclerotium rolfsfi* When the former disease attacks the vines, leaves suddenly lose their turgidity, become flaccid, droop, turn yellow and the plant dries up in the course of a week or less Dark water-soaked spots which get softened are found in the collar region of a dying vine. In the latter fungus, the presence of a thick white weft of mycelium enveloping the base of the plant is characteristic, resulting in the rapid rotting of affected portions of the stem and its shredding and eventual death of the plant.

Remedies. Rotate the crop with paddy and sugarcane and drain the land very well. Spray with Bordeaux mixture at the base and adopt clean cultivation.

Sugarcane. In this presidency this crop is chiefly subject to three maladies, red-rot, smut and mosaic.

Red-rot is known all over the world wherever sugarcane is grown. The characteristic symptom of this disease is the reddening of the internal tissue and then the cane withers and dries up. The quality of the juice gets deteriorated and very poor quality of jaggery is produced. The disease is spread to a large extent by planting diseased setts. The seed used for planting should be free from disease and this is best done by selecting setts from uninfected stools.

Mosaic. The disease is characterised by a peculiar mottling of the leaves. From a distance a badly infected field shows a dull green or yellowish tint instead of healthy dark green colour. On the leaf surface innumerable whitish or yellowish elongated patches appear. In some highly susceptible varieties the stem gets shrunk and the rind cracks. Mosaic may rightly be described as a wasting disease which does not kill the cane outright but causes material reduction in the tonnage of cane per acre. Some varieties like Red Mauritius, Java Hebbal and B 208 are susceptible varieties. The loss from mosaic has been estimated to be up to 40% in Porto Rico and 50% in Hawaii. Planting of setts from mosaic-free clumps, (2) systematic weeding of infected stools and (3) planting of resistant varieties keep this disease in check.

Smut. Affected plants are distinguished by the formation of a long whip-like dusty black shoot from the growing shoot covered by a thin membrane which ruptures and exposes the spores. The spores are blown about by the wind and healthy plants are infected. The fungus grows within the plant for a period and then affects the shoots when in the place of the growing spindle a long whip-like structure is formed.

Remedies. Since infection takes place through young shoots or eyebuds or a wound on the stem, seed treatment will not prevent the disease. A smutted plant can never recover but acts as source of infection to other healthy plants. Prompt removal and burning of the affected clumps are essential.

The Palms. *Palmyra bud-rot.* The bud-rot of palmyras and coconuts has been proved to be the result of an attack of a fungus *Phytophthora palmivora*. It is a severe epidemic disease of the palmyra palms in the Godavari and Kistna districts and Malabar. The first signs that a palmyra is diseased are (1) the central expanding leaf turns yellow and dries up or (2) rows of diseased spots are seen on the expanding leaves. When the central leaf dies, the growing point at the base dies. Soft rot sets in, which causes the leaf tissue surrounding the growing point to become soft and

rotten. The expanded leaves one after another wither, die and fall off. When the lower sheaths are cut off, brown spots are seen on the leaf blades, leaf sheaths and spathes.

Remedies. If the bud is not dead, but diseased spots are found on the leaves, all the affected leaves and leaf sheaths should be stripped If the bud is dead, the crown should be cut, split up into pieces and burnt.

Coconut bud-rot. The disease was first noticed in Malabar in 1912 and as a result of the supervision of the department kept in check when the usual operations for checking the disease were discontinued. Since then the disease has recurred and control measures have been adopted. The agricultural officers in the locality attend to it so that the disease is kept in check. The operation undertaken to reduce it consisted in cutting and burning the heads of dead palms and examination of the trees within 50 yards of the dead tree and operating those found to be affected. In tracts where the disease was bad the trees within a belt of 50 yards were examined.

Bleeding disease of coconuts. The presence of this disease is shown by a red viscous fluid oozing out from the stem of the tree. Trees gradually deteriorate and die. The control method consists in cutting out the affected part entirely, burning the wound with a lighted torch and then painting the cut surface of the wound with hot tar. In this way the disease can be exterminated. It is common througout all the coconut area in this presidency and especially it is very bad in places where the drainage is defective and the soil is alkaline.

'Mahali' or fruit rot and nut fall of arecanuts. The disease attacks young fruits and spreads rapidly during the monsoon by means of spores spread by wind and rain. The effect of the fungus is to cause the young fruits to rot on the bunches and drop down. If the attack is severe, major portion of the crop is lost. The treatment consists in spraying the bunches with Bordeaux mixture so as to give it a protective covering. This is done by means of a small spraying machine costing about Rs. 25. The ingredients for the mixture are cheap and simple and can be easily had from any bazaar and the cost of spraying 100 trees comes to about a rupee.

In arecanut gardens badly affected by 'mahali' disease coconuts were found to drop from trees showing symptoms similar to the rotting of arecanuts and with the same fungus on them. The arecanut disease fungus which was inoculated on coconuts produced same symptoms of rotting. The garden owners were advised to spray the coconut bunches, when they spray the arecanuts.

Fruits. *Grape-vine mildew.* The disease causes the fruits to rot which results in complete loss of crop in bad years. The result of spraying with Bordeaux mixture has been successful.

Spraying has become so popular that the entire area is now being sprayed. The garden owners purchase sprayers and chemicals themselves and spray all their vines themselves and every garden is now bearing heavily.

Plantain. The only disease of a very serious nature from which the plant suffers is what is known as 'Panama' disease or plantain wilt. The fungus lives in the soil and attacks the plant underground through the roots and rhizomes. Older leaves turn yellow from the margin or develop yellow spots and dry up In course of time, younger leaves also follow suit. In some cases, green leaves droop and break down, Often outer leaf sheaths also split. Bunches are rarely formed and when formed show signs of arrested development.

Remedies. Select suckers from disease-free localities, and attend to drainage.

To sum up, the various remedial measures detailed above may be classified under one or the other of the following heads :—

1. Plant protection (a) spraying (b) seed disinfection
2. Resistant varieties.
3. Field sanitation.
4. Rotation of crops.
5. Quarantine regulations.

Unless these measures are resorted to, no one can hope to expect an annual yield of thousand millions tons of plant matter which is the minimum, if this presidency is not to suffer from scarcity. In this connection, I should while concluding, sound a note of warning to those who rely on breeding alone for adequate yields. Plant breeders should beware of the crops' worst enemy "susceptibility to fungus attack". Any slight neglect of this most essential aspect is sure to land the breeder in utter failure, years of labour, energy and evolution of hundreds of strains notwithstanding. The lessons to be learned from the effects of red rot of sugarcane and blast of paddy should prove as sufficient warning. What matters it if you can show an increase of yield of 10% over control when the damage caused by disease ranges from 20 to 80%.

Some Experiences of the Varying Response of Different Millets and Cotton Strains to Local Areas in Cuddapah and Kurnool Districts.

By

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In recent times the study of plant life in relation to their environment is given greater prominence on account of its important and economic bearing in practical agriculture. In this branch of science called plant ecology, the influence of the various factors like light, temperature, water, physical, chemical and micro-biological properties of the soil on the developmental phases of different plants, are intensely studied It is, during the course of these studies that the terms "eco-types" and "eco-species" are employed to varieties of plants or cultivated crops which are considered as products arising through the sorting and controlling effect of the "habitat factors upon the heterogenous species population." Turesson proposed these terms with a view to maintaining a distinction between ecological and genetical units. Du Reitz while attempting to define sub-species and variety, wrote that the former is a population of one or several bio-types forming a more or less distinct local facies of a species. To draw a clear criterion is difficult; and an attempt is made in this paper of enumerating the experiences in testing the yield trials of the several strains of millets and cotton evolved at the Agricultural Research Station, Nandyal, in the several taluks of Cuddapah and Kurnool Districts where intense variations in soil fertility and other environmental factors are observed.

While discussing the "Problem of Cereal yield" in the world's Grain Exhibition and Conference, Canada in 1933 F. L. Engledow enumerates the two types of factors controlling yield. The first is the internal factors which belong to the plant and the second, the external factors which are the factors of the environment in its widest sense. According to him, there is a subtle inter-play between these internal and external factors and in agriculture each type has no absolute significance but must be conceived and measured in terms of the other. The environmental factors are usually associated with soil, climate and husbandry and the producer has very limited control over them. It is, in these respects that he has to adjust his methods by scientific aid.

In the two districts of Cuddapah and Kurnool, a detailed examination of the existing agronomic practices reveal that apart from the common

essential principles underlying this system of cultivation, there exist many differences in the several agronomic aspects of raising crops, mainly due to soil and environmental variations. The several modifications of agricultural practices adopted in these two districts with special reference to cultural operations, time of sowing, spacing, seed rate, rotation and other factors form an interesting subject of study to the agronomist.

It is not possible within the limited space of this paper to enumerate instances of the various modified agronomic practices and their relation to the changes in environmental conditions. In the Nandyal Valley seed drills with tynes 10½" and 18" apart are used for sorghum and cotton sowings respectively, while in Proddatur and parts of Jammalamadugu the 10½" tyned drills are used for both the crops. The sowings of these crops commence rather early in August in Allagadda and Proddatur taluks, where the rainfall is less, while they extend to September in Nandyal taluk. In Atmakur taluk sorghum is sown late in the season by about the first week of October when the rains practically cease. In a similar manner the varieties of millets grown differ markedly in their composition., Pithy stemmed varieties of sorghum are preferred in the Cuddapah district and in parts of Allagadda, while the sweet-stemmed ones are popular in the Kurnool district. These varieties differ to a considerable degree in duration, panicle shape, grain colour and size from tract to tract.

From 1935 onwards regular trials of sorghum, cotton and *korra* crops were conducted with about half a dozen strains in each crop in the different taluks of the two districts. The lay out in all the cases was in randomised blocks with suitable replications. A preliminary note on the response of these strains to local areas, based on the results of the first year was published*. The results indicated the variations in the yields due to changes in environmental conditions. The differential response of the several strains at the different centres and in the same centre was quite evident. The difficulty of securing a cosmopolitan strain to satisfy the requirement of the entire area, was apparent from the results, which exhibited wide variations in the cropping power of these soils. The necessity to conduct larger number of trials, scattered over as wide a range of area as possible, was realised.

The trials were continued in about ten district-work centres for each of these crops in Cuddapah and Kurnool districts consecutively for three seasons. The results were in accordance with the findings of the first year's experiences. Full particulars and summaries of these trials are furnished in this Station's Annual Reports for 1935—36, 1936--37 and 1937—38 It is not possible to recount in detail the experiences of each of these trials in this short paper. But, however, judging from the results of these trials for three seasons the following information is obtained.

Sorghum. (*Jonna or Cholam*). In the non-sweet stemmed area comprising all the taluks of the Cuddapah district and portions of Allagadda,

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strains 223 and 224 in sorghum have given good yield varying from 10 to 25 per cent increase over the local. These are pithy stemmed varieties and appear to be suitable in Proddatur, Cuddapah and portions of Allagadda taluks. Among the sweet stemmed varieties in this area, strains 28/3 and 29/68 have given better yields than local in some places while in other localities they are equal to local in their performance.

In the sweet stemmed area comprising the taluks of Kurnool District, N. 28/3 sorghum has given good yields in the majority of trials. This strain is characterised by medium sized grain with dull yellow colour and it seems to be well adopted to soils of medium and poor fertility, the increase in yield ranging in some of the localities from 10 to 15 per cent. At the Agricultural Research Station, Nandyal, this strain has given consistently high yields in all the trials for the last four seasons and this is now being multiplied in the several district work centres for distribution to ryots. In Koilkuntla and Nandyal taluks, N. 29/68 commands greater favour on account of its bold grain with lustrous yellow colour. It thrives well in soils of good and medium fertility and this strain is now being distributed in such areas in the Nandyal valley.

Italian Millet. (*Setaria italica*). *Korra or Tenai.* In the *Korra* crop, strain 132 has given good yields in the trials, the increase over local ranging from 15 to 30 per cent in Kurnool, Koilkuntla and portions of Nandyal and Allagadda. Strains 140 and 125 find favour in Rajampet, Cuddapah, Proddatur and portions of Nandyal taluk. These sirains have long compact panicles, good setting to the very base, absence of tip sterility and good tillering capacity. Strain 132 has given a maximum yield of 1,200 lb. under rainfed conditions in Nandyal valley and 2,000 lb. under irrigation in Rajampet taluk. These strains are now being multiplied and distributed in the respective centres.

Cotton. The cotton strains N. 23 and N. 29 have given good yields in the Cumbum area, the percentage of increase over N. 14 ranging from 15 to 20 per cent. Strain N. 14 in the Nandyal valley has a steady performance in select areas. In many trials it is equal in yield to local and produces superior lint. The "local" which is a mixture of indicums and herbaceums shows wide variations in yield of kapas due to seasonal influence and hence is not reliable. Besides, its quality is inferior and fetches a low price in the market; while N. 14—a steady performer noted for its high staple strength and spinning value, finds a ready sale at a higher price, at 25 to 30 per cent more than the locals Efforts are now being made to raise adequate areas under seed farms with a view to meet the large demand for this seed in Nandyal valley.

Apart from these trials in districts, two more sets of trials were conducted by the station staff last season in typical villages in the vicinity of the Agricultural Research Station, Nandyal. They are, (1) Zone classification trials and (2) the Cropping power trials.

(1) *Zone Classification Trials.* The object of these trials is to verify whether there exist in this tract definitely different zones of soils naturally formed which do not permit interchangeability of seed from one zone to another in sorghum crop, as is popularly believed. For this purpose mass selected seed from these well defined zones was gathered and trials conducted in each of these centres.

Out of the fives trials conducted, the varietal differences are significant in four cases. At Kanala, the mass selected seed of the four zones is better than the local. At Ayyalur and Parnapalle, the mass selected seed from Balapanur tract has given better yields while the others are equal to' local. The results on the farm are consistent with those of the previous year, strain 28/3 giving the highest yield. The popular prejudice against interchangeability of seed from tract to tract is thus partly true.

(2) *Cropping Power Trials.* These trials were conducted in villages in the vicinity of the farm with a view to find out the cropping power of these soils with respect to the several types of sorghum strains. Of the four, the varietal differences are significant in one case. Strain N. 2803 has given uniformly good yields in all the localities. The variation in the yields of the respective locals in these trials clearly brings out the cropping powers of these soils, as judged by the results of these trials.

SELECTED ARTICLE

Soil Erosion in India.

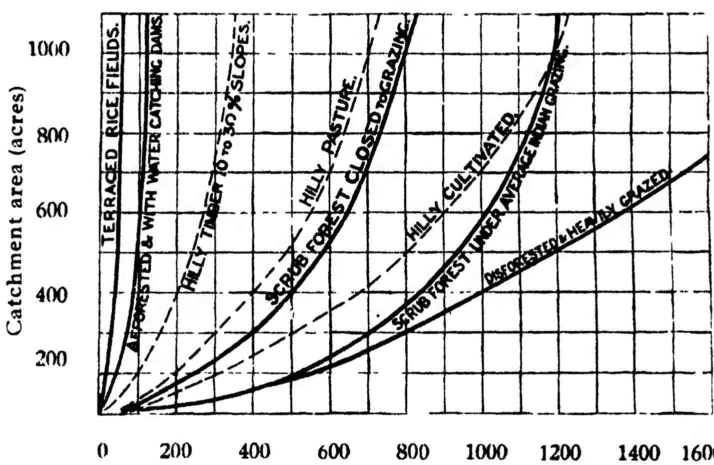
By Dr. R. MACLAGAN GORRIE

Contrasts with American Data. Erosion losses are less where the rainfall is well distributed, and it is now commonly recognized that erosion has most serious consequences in arid tracts. A heavy monsoon has more effect upon sloping fields than it has on neighbouring grasslands, whereas in arid climates the smaller area of fields is more carefully terraced, but the neighbouring grazing grounds are more vulnerable to infrequent but heavy downpours. This may serve to explain an anomaly that occurs in run-off intensity data. American figures worked out by Ramser and frequently quoted show the following averages in cubic feet per second per square mile, and in contrast I also quote tentative data of the same sort for Indian conditions.

Run-off in cubic feet per second per square mile.

America.	Cusecs.	*Punjab.*	Cusecs
Hilly timber, 10—30% slope	300	Terraced rice fields	50
" pasture, 10—30% slope	620	Foothills afforested and with soil-catching small dams ...	120
" cultivated 10—30% slope	1040	Foothills scrub forest closed to grazing	700
		Foothills open to grazing ...	1100
		Foothills disforested and heavily grazed	1600

The American farmer using a motor-tractor keeps his fields large, and so the run-off from broad slopes of bare plough land is greater than from his paddocks of comparatively well clothed pastures. This also applies to Canadian and Australian average conditions and to parts of South Africa. On the other hand, the Indian peasant farmers have their fields in tiny and often well-terraced units which catch and hold the rain-fall, whereas their grazing grounds are so misused and so badly protected with a mutilated plant cover that the run-off from them is far heavier. In the African dependencies, according to Sir Frank Stockdale's statement at a meeting of colonial officers held in Oxford in June 1937, "agricultural activity was as frequently to blame for erosion as overstocking with live-stock," so probably their run-off figures would be equally heavy for cropped land as for grazed land. Reliable data for run-off and erosion, and also for rainfall intensities and storm behaviour, are lamentably scarce even for our most important catchments, and a great field of work awaits the next generation of colonial research workers.



Comparative run-off for American and Punjab conditions.

American data from C. E. Ramser's curves (broken lines) Indian data from Pabbi Hills torrent measurements by Irrigation Branch (full lines).

Rainfall and River Behaviour. Mr. E. G. Bilham's paper on "Weather and Water-Supply" read at the Public Works Congress, 1937, directs attention to the fact that even in Great Britain very few attempts have so far been made to correlate the loss of rainfall by evaporation, surface run-off, and seepage with the behaviour of streams. More work is required upon the actual fate of all the rain that falls upon a given type of plant cover and the contribution which this cover makes to the nearest stream in terms of surface and ground-water flow, before we can discuss intelligently the reactions of the larger rivers.

A study of the Ravi River flow records for the last twenty-five years carried out by the staff of the Punjab Irrigation Research Institute shows no significant indication of any gradual increase in number or intensity of floods nor any direct correlation of heavy floods with heavy rain. This is presumably owing to the fact that the heaviest floods arise from heavy snow-melt in the high inner hills, combining with a series of downpours falling on eroded ground in the foothills. The figures of winter flow do, however, indicate a continued deterioration in supplies available for winter irrigation. It is scarcely to be expected that a simple phenomenon such as the run-off of rain can be correlated exactly

with the highly complex phenomena which go to make up the stream-flow of a large river. The Ravi River's catchment of nearly 15.000 square miles varies from 2,000 ft. to 20,000 ft. in altitude and contains several recognizable meteorological zones, so instead of looking for any correlation between rainfall and run-off for the whole, it would be better to study small individual sections and find out how each tributary reacts to the rain and snow which fall within its catchment. Unfortunately, the rainfall data in this case are for only one rain gauge for the 15,000 square mile.

New Indian Statistics of Erosion Losses. Reliable run-off figures for forest and grassland are now available for the first time for Indian conditions. A technique of volumetric analysis of water and silt was worked out by the Punjab Irrigation Research staff at Madhopur in 1935 for a type of small isolated plot of undisturbed soil 3½ sq. ft. in area, and this method has since been followed in forest plots at Nurpur in Kangra district. A battery of six plots gave three pairs namely, (i) grass, (ii) grass and shrubs, and (iii) bare soil, on a slope of 1 in 4 on an eroded hillside of poor Siwalik sandstone. The grass cover over all is distinctly poor, as it is recovering slowly from previous heavy grazing. The bare plots contain a little grass which has been kept clipped back with scissors. They thus simulate local grazing conditions to some extent, though we have not reproduced the destructive trampling action of cattle scrambling on a grassy hill-side; and the run-off from grazed areas must therefore be considerably heavier than the figures now reported.

The results of the first monsoon's catch are as follows:—

Percentage of rain which ran off:	Grass 80% cover.	Grass and shrubs 90% cover.	Bare soil, grass clipped every 3 days.
Out of total of 46 in 32 wet days during July—October 1937	7	5	25
Out of total of 5¼ in. in 4 hours, the heaviest single storm	2·2	1·7	6
Weight of soil lost per acre:			
Carried away on 32 wet days ...	35,000 lb.	3,900 lb.	18,500 lb.
Carried away by a single storm (5¼ in. rain) ...	260 lb.	307 lb.	3,511 lb.

These figures give one food for thought when it is realized that in a single storm the uncovered plots lost soil at the rate of 1½ tons per acre. This may be taken as a typical figure for all bare fallow fields in the foot-hills of northern India except properly levelled rice land, and they are definitely conservative for the average village grazing lands which suffer from trampling of cattle. The ordinary grazing lands also suffer from the accumulative action of shallow gullies cutting the surface on long slopes, a phase of erosion which is of course not reproduced in our square plots.

Measurements reported from the Bombay Dry Farming Research Station at Sholapur (chief investigator, Mr. N. V. Kanitkar) show a loss of 115 tons of soil per acre per annum from a field of jowar, (A. Sorghum) which is the most important combined grain and fodder crop in the Bombay Daccan. This loss was caused in a properly cultivated plot as a result of two very intense storms of 3·5 in. and 4·3 in. The total rainfall of 28 inches is usually fairly well distributed and no such intense storms occurred during the previous year when measurements were started. The silt lost in these intense storms was particularly rich in valuable plant foods such as lime and potash, which were stolen by erosion, leaving the remaining soil much poorer. Of the various other kinds of plant cover tested, the amount of water lost in the run-off was not strikingly different where weed

or crop cover was dense. The amount of soil lost where the weeds had been reserved in fallow was just one two hundredths of the jowar plot, while the clean fallow of bare but uncultivated ground yielded 25 tons of soil per acre or 22 per cent. of the jowar plot's loss. These astonishingly heavy losses of silt were from very gently sloping ground, the average slope being 1¼ per cent. or 1 in 80, and the data are entirely reliable, having been collected from thoroughly isolated plots. I am indebted to Mr. Kanitkar and Dr. W. Burns for permission to use these figures.

The point which this experiment has brought out is that, under Indian conditions, good cultivation on even a slight slope is no better than bad cultivation for saving soil, unless it is protected by some form of contour ridging. The only sure way of reducing soil losses during exceptionally heavy storms is by contour ridging which is sufficiently deep to render each field a more or less self-contained catchment unit, so that cumulative run-off from a series of fields is prevented. The necessity for such protection is brought out by subsequent figures for these same plots in 1937, so far unpublished but furnished in a letter from Mr. N. V. Kanitkar who reports that this same jowar plot has lost a total in the year of 133 tons per acre. This included one storm in which 2·13 in. of rain in half an hour removed the huge amount of 52 tons of silt per acre.

(*Nature*, Volume 142, No. 3595)

EXTRACTS

THE DUST BOWL CAN BE SAVED

In the Autumn of 1935, I travelled the length and breadth of the dust bowl—an area more than twice as large as all New England, embracing parts of the five Southwestern states. Even on days of low wind velocity, I saw banners of gray dust playing across fields as barren as the moon. Much of the crop land was so badly drifted that some soil experts doubted it would ever produce again.

Today the dust bowl still exists, but it has shrunk. Last autumn I followed the roads I drove over in 1935. and found the land miraculously dotted with lush green fields of drought-resistant crops—milo, Sudan, maize, broom corn. Near Dalhart, Texas, where two years ago the wind had piled up sand dunes 30 feet high, hardly a spot of bare sand was left exposed. Right up the slopes of the dunes, which are now only eight or ten feet high, grew a healthy stand of corn. Shortly before, roasting ears had been plucked from stalks six feet tall.

This dramatic triumph of agricultural science is part of an amazing demonstration that proves the dust bowl can be saved. Two years ago the Department of Agriculture's Soil Conservation Service leased for experiment a 900 acre tract near Dalhart. The first step was to anchor the lands around the dunes with tough, drought-defying cover crops. Then during the winter and spring seasons of high winds the tops of the ridges were loosened with tillage implements. Day after day the wind scoured off the sand and deposited it in a thin layer out through the surrounding stubble. During the growing season corn was planted on the dunes to protect the adjacent areas of maize. A few more years of this program and the entire 900 acre tract probably will be as level as a floor.

A more significant phase of the work has been the reclamation of thousands of acres of crop land that had been wrinkled up into low hummocks of silt and sand. Recently, with the assistance of the Soil Conservation Service, the farmers have knocked down the hummocks with road graders, conserved every drop of rainfall by careful tillage, and planted crops that would anchor the soil. As a result, last fall I saw first-rate crops of sorghum, Sudan and broom corn on hundreds of such fields, which two years ago were among the millions of acres that

soil experts had labelled "destroyed". The relatively virgin soils of the dust bowl are exhibiting an astonishing resiliency.

The Government's program of improved farming has three basic points: conservation of moisture, the consistent use of cover crops, and a cessation of the disastrous practice of planting wheat in a dry seedbed.

Rain in the dust bowl often comes in severe bursts, and although the land seems level, it usually slopes enough so that the water runs off quickly. Contour farming is stopping this. Guide lines are run by engineers through the fields—each line on a level, across the slope of the land—and the fields are then plowed accordingly. Instead of running off, rain water cascades into the furrows, backs up and sinks into the soil. Broad, low terraces also are thrown across the fields, to catch water which escapes the furrows. They are so low, their slopes so gradual, that crops are grown upon them; and properly farmed, they last for ever.

The Soil Conservation Service has blocked out 13 large demonstrational projects on lands that are privately owned; farmers come into the scheme voluntarily and continue to do their own farming, but in accordance with the Soil Conservation plan. The government performs certain tasks for them, such as the building of terraces.

At Liberal, Kansas, I talked with one of these farmers. One of his fields, of 320 acres, was terraced; it yielded 17½ bushels of wheat to the acre. His remaining 530 acres, farmed in the conventional way, yielded only nine bushels per acre. My notebook is full of similar convincing testimony.

Moisture conservation alone will not save the dust bowl. In great drought the subsoil is parched far below the root growth. If a farmer makes his fall sowing of wheat then, the chances are that his fields will blow away in the spring.

So, about two years ago, government research men went to work on this problem and painstakingly charted many years' records of yields, precipitation and subsoil moisture. They found that unless there is 24 inches of subsoil moisture at seeding time the wheat crop will be a failure, leaving the fields unprotected against wind erosion. They demonstrated that all a farmer need do is to test his fields in the fall with a soil auger, and from the amount of moisture he finds he can predict accurately his chances of making a harvest nine months later.

"If all our farmers would plant cover crops when there isn't enough subsoil moisture for wheat," said Ray Throckmorton, chief agronomist at Kansas State Agricultural College, "it wouldn't be so hard to stop the black blizzards. But it is tough to ask a wheat farmer—particularly one who is already busted flat—to stay out of wheat and protect his land".

Perhaps the best cover crop is the dwarflike, knee-high milo now being grown on the southern high plains. Ten years ago there was nothing much to plant but the tall kaffirs and milos, natives of lower altitudes, which were hammered down by the winds and killed by the fierce summer sun. After years of careful work, J. B. Sieglinger, plant breeder of Oklahoma, produced a stout variety of milo which withstands prairie winds and sun; it produces a full fat head of grain and can be harvested with wheat combines. This year there were hundreds of thousands of acres of Sieglinger's milo in the dust bowl, produce in many cases on less than 10 inches of rainfall.

In spite of all this new knowledge, I saw, even last fall wheat drills going in hundreds of powdery fields, where subsoil moisture is completely exhausted. Next spring many of those fields will "go to hell in a handbasket" as they say locally carrying adjacent lands with them.

The farmers know this in a haphazard way, but the land of big wheat has always been gambler's country. Even today, some of the big growers are looking forward to a return of the lush years when they harvested and sowed and went to California for the winter. Mere campers on the land, they don't want to be tied down by diversified farming.

Moreover, it takes money to change the character of farming throughout a whole region, and the dust-bowl farmer is broke. The more extensive use of cover crops implies the raising of livestock to make use of the fodder — and that takes capital to get started. Even contour farming costs from six to ten percent more than conventional methods. The wheat drills I saw rolling along in choking dust last autumn were run, in many cases, by men who, unable to afford a change in farming methods, were making a last desperate gamble. Government men are hopping for enough funds to remove, by outright purchase, the most hazardous soils from such mistaken efforts.

About a year ago there sat in my office a brisk traveller from a blow country 110 000 miles away. He was E. S. Clayton, chief experimentalist of the Australian Department of Agriculture. Australia has red blizzards that roll out of the arid interior, fog down into the coastal cities and sometimes stain the air for hundreds of miles out across the Tasman Sea.

So serious has wind erosion become that in some localities the vast sheep industry is threatened with ruin, and many wheat growers in the once rich Mallee lands are about at the end of their tether. Mr. Clayton was circling the earth studying control methods in other countries. " You Americans," he said " are doing very effective work in your dust bowl. I wish we had made as good a start in Australia."—(*Readers Digest*, February 1938).

Agricultural Jottings.

(From the Director of Agriculture, Madras.)

IMPORTANCE OF HEAVY MANURING FOR PADDY NURSERY

Paddy nurseries occupy roughly one-tenth of the area under paddy crop in all tracts where transplanting is practised. These are of ten different sites selected for *Kuruvai* and the subsequent *samba* and second crop nurseries. In all cases the nursery is no doubt slightly better manured than the planted paddy crops. But after removal of the thickly sown seedlings, the yield of the paddy planted in the nursery is not such as to compensate the cultivation expenses, and so very often, the nursery area is neglected if not abandoned. This is more often noticed in the case of *samba* and second crop nurseries. It is not in the interest of the country to waste such a large extent as a tenth of the area under paddy cultivation.

The following instance of how paddy land has not only been improved by manuring, but has consistently been able to raise 3 crops of seedlings each year—*kuruvai*, *samba* and *thaladi* or second crop—and still keep up a very high yield of paddy will convince the paddy farmer, how he should look after his nursery and increase his return. Field No. 68-B is a bit of wetland in the centre of the paddy lands of the Palur Agricultural Research Station. When this station was acquired about 1907-8, this plot gave an acre yield of only 927 lbs. By the application of green manuring mainly *daincha*, it was possible to increase the yield during the next 10 years to 2,750 lbs. per acre, and two such crops were later raised in the same field giving upto 5,500 lbs. per acre. After bringing this field to this state of fertility it was decided to convert this plot as a paddy nursery of which

the first was raised in 1921. With proper manuring with green leaf and reduction of seed rate to one Madras measure of paddy per cent. of nursery, the seedlings were exceedingly healthy and single planting was easily possible. Seven cents were found sufficient to plant an acre, thus reducing the area required for nursery from $\frac{1}{10}$ to $\frac{1}{14}$ of the total area under paddy. After the removal of seedlings two crops of paddy were raised and later two nurseries and a paddy crop were raised. This system continued for 10 years and during this period 20 nurseries and 11 paddy crops were raised and the average yield of paddy after 2 nurseries each year was 2,711 lbs. per acre. A further intensive treatment was started afterwards and during the last eight years three nurseries (1) *Kuruvai* (2) *Samba* (3) *Second* crop samba were raised, one following the other and after the removal of the third batch of seedlings, a late variety, viz. Poombalai was planted and it is satisfactory to note that the yield of paddy has risen still further giving an annual average of 2,955 lbs per acre, which is higher than the farm average yield of *samba* for the same period.

The system of manuring adopted is this. After thorough puddling of the nursery, 5 to 10 cartloads of outside leaf is trampled and the seed sown at 1 M. M. per cent. If for any reason the seedling does not appear healthy a dressing of ammonium sulphate is given at 1 lb. per cent. The planted paddy crop is given about $\frac{3}{4}$ candy groundnut cake or 2 cwts. (1 full bag) bonemeal per acre. It will thus be noted that with a much smaller area of nursery, well treated, we can get healthy seedlings for single planting and also raise a very good paddy crop.

The Agricultural demonstrator stationed at the headquarters of your taluk will help you to raise such a nursery.

(One Madras measure of paddy is about $2\frac{1}{2}$ lbs.)

Correspondence.

AGRICULTURAL PROPAGANDA—AN IDEA

To

The Editor,

Madras Agricultural Journal.

Sir,

Due to the efforts of a former Director of Agriculture we have on hand a set of very nice songs on agricultural improvements; more could probably be composed. Their practical use at present is very limited, indeed, as most of the demonstrators are not talented musicians. What I suggest is that the services of renowned musicians (e. g. Musiri Subramania Ayyar, S. D. Subbalakshmi, K. B. Sundarambal, Chembai Vaidyanadha Bagavathar, and others) may be secured to sing our songs for gramaphone recording and making use of these records in propaganda in villages. Each demonstrator could probably be equipped with a gramaphone and a set of these records to play for the amusement of the villagers when he halts amidst them in his tours. This will be a very effective method of securing a good audience in the villages and inculcate in them new ideas. The songs may also be broadcast through the radio recently introduced in Madras. Records can also be made of set speeches in the different vernaculars on various subjects by persons who have a fine recordable voice and other attributes of a good lecturer and these can be played in villages, cinema halls, radio broadcasting stations, etc. either by themselves or interposed with gramaphone music referred to in the paragraph. This method of propaganda is adopted by some of the trade concerns e. g. Horlicks, Lux Toilet Soap, etc. with conspicuous success.

A member of the M. A. S. U.

[We invite correspondence on this subject. Ed. M. A. J.]

Crop and Trade Reports.

Paddy--1938-39—Intermediate report. The main crop of paddy has been or is being harvested in parts of the Circars, the Deccan, the Central districts and Tanjore. The yield is reported to be normal in Guntur, Kurnool and Anantapur and below normal in the other districts.

The crop has been affected by drought in most of the important paddy growing areas, especially in the Carnatic and the Central districts owing to the failure of the North-east monsoon rains. The crop has also been affected by an attack of insects in parts of Coimbatore.

The wholesale price of paddy per imperial maund of 82$\frac{2}{7}$ lbs. as reported from important markets on 9th January 1939 was Rs. 3—6—0 in Vellore, Rs. 2--14—0 in Madura, Rs. 2—13—0 in Chittoor, Rs 2—11—0 in Virudhunagar, Rs. 2—10—0 in Trichinopoly, Rs. 2—9—0 in Tinnevelly, Rs. 2—6—0 in Vizianagaram and Cuddalore, Rs 2—5—0 in Rajahmundry, Guntur and Kumbakonam, Rs. 2—4—0 in Ellore, Bezwada, Masulipatam and Conjeevaram, Rs. 2—3—0 in Nagapatam, Rs. 2—2—0 in Cocanada, Rs. 2—0—0 in Hindupuram, Rs. 1—15—0 in Mangalore and Rs. 1—14—0 in Anantapur. When compared with the prices published in the last report, i. e those which prevailed on 5th December 1938 these prices reveal a rise of about 59 per cent in Vellore, 19 per cent in Cuddalore, 13 per cent in Negapatam and Chittoor, 12 per cent in Kumbakonam, 9 per cent in Conjeeveram, 8 per cent in Trichinopoly, 5 per cent in Madura and 3 per cent in Tinnevelly and a fall of about 12 per cent in Guntur, 11 per cent in Hindupur, 10 per cent in Bezwada and Virudhunagar, 8 per cent in Cocanada and 5 per cent in Ellore, the prices remaining stationary in Vizianagaram, Rajahmundry and Mangalore.

Cotton—1938-39—Third forecast report. The average of the areas under cotton in the Madras Province during the five years ending 1936-37 has represented 9·6 per cent. of the total area under cotton in India.

The area under cotton up to the 25th November 1938 is estimated at 1,505,400 acres. When compared with the area of 2,118,600 acres estimated for the corresponding period of last year, it reveals a decrease of 28·9 per cent.

The decrease in area is general in all the important cotton growing districts of the Province and is attributable largely to unfavourable season conditions.

The area under irrigated cotton, mainly cambodia, is estimated at 129,400 acres as against 227,400 acres in the corresponding period of last year thereby representing a decrease of 43 1 per cent.

Pickings of the *mungari* or early sown crop in parts of the Deccan are in progress and the yield is expected to be normal. The condition of the *hingari* or late sown crop in the Deccan is also satisfactory. The growth of the crop in the Central Districts has been affected to some extent due to the withholding of the North-east monsoon rains

Yields below normal are reported from all the districts outside East Godavari, West Godavari, Guntur, the Deccan (Cuddapah excepted), South Arcot, Chittoor, Tanjore and the West Coast. The seasonal factor for the Province as a whole works out to 97 per cent. of the average as against 93 per cent. in the previous year. On this basis, the total yield is estimated at 294,200 bales of 400 lb. lint as against 439,700 bales of last year, thereby representing a decrease of 33·1 per cent. The crop is young and it is too early to estimate the yield with any degree of accuracy.

The estimated area and yield according to varieties are given below :-

(Area in hundreds of acres, i.e., 00 being omitted ; yield in hundreds of bales of 400 lb lint, i.e., 00 being omitted.)

Variety.	Area from 1st April to 25th November.		Corresponding yield.	
	1938. Acs.	1937. Acs.	1938. Bales.	1937. Bales.
(1)	(2)	(3)	(4)	(5)
Irrigated Cambodia	127,4	217,4	73,3	135,9
Dry Cambodia	159,6	245.2	32,1	53,2
Total, Cambodia ...	287,0	462.6	105,4	189,1
Karunganni in Coimbatore ...	47,0	115,5	9,3	26,2
Uppam in the Central districts ...	17,2	27,0	2,7	4,9
Nadam and Bourbon	2,5	21,8	2	1,1
Total, Salems ...	66.7	164,3	12,2	32,2
Tinnevellies*	223,0	326.0	54,6	83,9
Northerns and Westerns ...	820,0	1,041,0	102,2	111,7
Cocanadas	103,5	117,7	19,2	21,9
Others	5,2	7,0	6	9

* Includes Uppam, Karunganni and mixed country cotton in Madura, Ramnad and Tinnevelly.

The local cotton trade is not generally active at this time of the year. The average wholesale price of cotton lint per imperial maund of 82$\frac{2}{7}$ lb. as reported from important markets on 5th December 1938 was about Rs. 13-13-0 for Cocanadas, Rs. 16-7-0 for Red Northerns, Rs. 14-4-0 for White Northerns, Rs. 12-7-0 for Westerns (*mungari* crop), Rs. 13-7-0 for Westerns (*jowari* crop), Rs. 25-1-0 for Coimbatore Cambodia, Rs. 20-1-0 for Southern Cambodia, Rs. 21-4-0 for Coimbatore Karunganni, Rs. 20-8-0 for Tinnevelly Karunganni, Rs. 17-11-0 for Tinnevellies, and Rs. 17-9-0 for Nadam cotton. When compared with the prices published in the last report, i. e., those which prevailed on 7th November 1938, these prices reveal a rise of about 32 per cent. in the case of Tinnevelly Karunganni, 24 per cent. in the case of Tinnevellies, 20 per cent. in the case of Southern Cambodia, 13 per cent in the case of Coimbatore Cambodia, 11 per cent. in the case of Westerns (*mungari* crop) 7 per cent. in the case of Coimbatore Karunganni and Nadam and 3 per cent. in the case of Westerns (Jowari crop), the prices of Cocanadas and Northerns (red and white varieties) remaining stationary.

Cotton—1938-39—Intermediate forecast report. Pickings of the *mungari* or early sown crop in parts of the Deccan are in progress and the yield is expected to be normal. The *hingari* or late sown crop in Kurnool, Bellary and Cuddapah received a set back owing to the withholding of the North-east monsoon rains but the cold winds have pulled up the crop to some extent. Poor and insufficient rains during the North-east monsoon period affected the growth of the crop in the central districts. In Salem and Coimbatore the crop was also affected to some extent by the attack of insects. The condition of the crop is fairly satisfactory elsewhere in the Province.

The wholesale price of cotton lint per imperial maund of 82,2/7 lbs. as reported from important markets on 9th January 1939, was Rs. 15-4-0 for Cocanadas, Rs. 14-13-0 for red Northerns, Rs. 13-7-0 for white Northerns, Rs. 12-12-0 for Westerns (*mungari* crop) Rs. 13-12-0 for westerns (*jowari* crop), Rs. 25-1-0 for Coimbatore Cambodia, Rs. 20-6-0 for Southern Cambodia, Rs. 21-8-0 for

Coimbatore Karungari, Rs. 19-13-0 for Tinnevellies Karunganni, Rs. 18-7-0 for Tinnevellies and Rs. 17-14-0 for Nadam cotton. When compared with the prices published in the last report i. e. those which prevailed on 5th December 1938, these prices reveal a rise of about 10 per cent in the case of Cocanadas, 4 per cent in the case of Tinnevellies, 3 per cent in the case of westerns (early crop), 2 per cent in the case of Westerns (late crop), Southern Cambodia and Nadam cotton and 1 per cent in the case of Coimbatore Karunganni and a fall of about 10 per cent in the case of red Northerns, 6 per cent in the case of white Northerns and 3 per cent in the case of Tinnevelly Karunganni, the price of Coimbatore Cambodia remaining stationary.

Groundnut—1938—Fourth or final report. The average of the areas under groundnut in the Madras Province during the five years ending 1936-37 has represented 47·8 per cent of the total area under grountnut in India.

The area sown with groundnut in the Province in 1938 is estimately at 3,835,300 acres. When compared with the corresponding estimate of 4,564,800 acres for the previous year and the acutual area of 4, 657,596 acres according to season and crop report of the previous year, the present estimate reveals a decrease of 16·0 per cent and 17·7 per cent respectively. The estimated area for this year exceeds the average area of 3,075,230 acres by about 24·7 per cent.

The decrease in area is general outside Vizagapatam, East Godavari, Chingleput, Coimbatore, Trichinopoly and Malabar.

3. The harvesting of the summer and early crop of groundnut had concluded by the end of October. The harvesting of the winter or main crop is proceeding.

The crop was affected by heavy rains at the time of harvest in Kistna and by drought in most of the other districts. The crop has also been affected to some extent by an attack of insect pests in Bellary, Anantapur and Salem. In consequence, the yield is expected to be below normal outside East Godavari, Guntur, Tinnevelly and Malabar. The yield is estimated to be very low in Kistna (59 per cent), Nellore (55 per cent), South Arcot (47 per cent) and North Arcot (56 per cent). The seasonal factor for the Province as a whole works out to 76 per cent of the average as against 88 per cent in the previous year according to the season and crop report. On this basis, the yield is expected to be 1,448,500 tons of unshelled nuts as against 2,059,270 tons in the previous year, a decrease of 29·7 per cent. The yield in an average year is estimated at 1,540,280 tons.

The wholesale price of groundnut (shelled) per imperial maund of 82.2/7 lbs. (equivalent to 3,200 tolas) as reported from important markets on 9th January 1939 was Rs. 4-5-0 in Cuddalore Rs. 4-1-0 in Vizagapatam, Rs. 4-0-0 in Guntur, Rs. 3-14-0 in Vizianagaram, Rs. 3-9-0 in Coimbatore and Anantapur, Rs. 3-8-0 in Cuddapah. Vellore and Tadpatri, Rs. 3-4-0 in Nandyal, Rs. 3-3-0 in Adoni and Hindupur and Rs. 3-2-0 in Bellary. When compared with the prices published in the last report i. e. those which prevailed on 7th November 1938, these prices reveal a rise of about 19 per cent in Tadpatri, 13 per cent in Hindupur, 12 per cent in Vizagapatam, Cuddapah and Coimbatore, 11 per cent in Adoni, 10 per cent in Guntur and Nandyal, 9 per cent in Vizianagaram and Cuddalore and 6 per cent in Bellary and Vellore and a fall of about 5 per cent in Anantapur.

Castor—1938—First or Final Report. The average of the areas under castor in the Madras Province during the five years ending 1936-37 has represented 18·6 per cent. of the total area under castor in India.

The area under castor in the Madras Province up to 25th November 1938 is estimated at 256,000 acres. When compared with the area of 240,800 acres estimated during the corresponding period of last year, it reveals an increase of 6·3 per cent. The estimate for last year was below the actual area of 246,718 acres by 2·4 per cent.

An increase in area is estimated in Vizagapatam, Guntur, the Deccan, Nellore, South Arcot, Chittoor, North Arcot, Trichinopoly, Tanjore and Malabar partly counterbalanced by an estimated decrease in area in East Godavari, West Godavari, Kistna, Salem, Coimbatore, Madura and Tinnevelly.

The yield is expected to be slightly above normal in Kurnool and Bellary, below normal in North Arcot, Salem and Coimbatore and normal in the other districts. The crop has been affected by drought to some extent in parts of the districts of Chittoor, North Arcot, Salem and Coimbatore. The seasonal factor for the Province as a whole is estimated to be 100 per cent. (normal) as against 94 per cent. for the corresponding period of the previous year and 90 per cent. according to the season and Crop report of last year. On this basis, the yield is estimated at 25.700 tons as against 24,000 tons estimated for the corresponding period of last year and 22,360 tons estimated in the season and crop report of last year.

5. The wholesale price of castor seed per imperial maund of 82 $\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 19th December 1938 was Rs. 5-4-0 in Nandyal. Rs 5-2-0 in Cuddapah, Rs. 4-12-0 in Vizagapatam, Rs. 4-10-0 in Vizianagaram, Rs 4-8-0 in Guntur and Anantapur, Rs. 4-3-0 in Salem, Rs. 4-2-0 in Hindupur and Rs 4-1-0 in Bellary. When compared with the prices reported in the previous year, i. e., those which prevailed on 20th December 1937, these prices reveal a rise of 17 per cent. in Cuddapah, and a fall of 14 per cent. in Salem, 13 per cent. in Vizagapatam and Vizianagram, 12 per cent. in Guntur, 11 per cent. in Hindupur and 2 per cent. in Bellary, the prices remaining stationary in Nandyal and Anantapur.

Gingelly—1938-39—Third Report. The average of the areas under gingelly in the Madras Province during the five years ending 1936-37 has represented 15·4 per cent of the total area under gingelly in India.

The area sown with gingelly up to 25th December 1938 is estimated at 575,300, acres. When compared with the area of 546,400 acres estimated for the corresponding period of last year, it reveals an increase of 5·3 per cent.

There is an increase in area in the Circars (Vizagapatam excepted), the Deccan, Nellore, South Arcot, Trichinopoly and the South partly counterbalanced by a decrease in area in the rest of the Province. The variations are marked in Vizagapatam (minus 22,000 acres), East Godavari (plus 12,000 acres), West Godavari (plus 26,000 acres), Anantapur (plus 10,000 acres) Chingleput (minus 11,700 acres), North Arcot (minus 23500 acres), Coimbatore (minus 10,000 acres) and Trichinopoly (plus 29,000 acres).

The main crop has been harvested except in the South. The crop was affected by heavy rain at the time of harvest in Kistna and by drought in most of the other districts. In consequence, the yield is reported to be below normal in all districts except West Godavari, Guntur, Kurnool, Bellary, Anantapur, Tanjore, Tinnevelly and South Kanara.

The seasonal factor for the province works out to 84 per cent of the average as against 90 per cent for the corresponding period of last year. On this basis, the yield is estimated at 65,400 tons as against 66,300 tons for the corresponding period of last year, a decrease of 1·4 per cent.

The wholesale price of gingelly per imperial maund of 82 $\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 9th January 1939 was Rs. 6-12-0 in Trichinopoly, Rs. 6-10-0 in Tinnevelly, Rs. 6-1-0 in Salem, Rs. 6-0-0 in Cocanada, Rs. 5-15-0 in Cuddalore, Rs. 5—11—0 in Rajahmundry, Rs. 5-9-0 in Ellore, Rs. 5-4-0 in Vizagapatam, Rs. 5-2-0 in Vizianagaram and Tuticorin. When compared with the prices published in the last report, i. e., those which prevailed on

7th November 1938, these prices reveal a rise of about 12 per cent in Cocanada, 11 per cent in Vizagapatam, 10 per cent in Ellore 8 per cent in Tinnevelly, 7 per cent in Rajahmundry and 3 per cent in Trichinopoly and a fall of about 8 per cent in Tuticorin, the prices remaining stationary in Vizianagaram, Cuddalore and Salem.

Ginger--1938—Final Report. The area under ginger in 1938 is estimated at 11,300 acres in Malabar and 500 acres in South Kanara as against the actual area of 10,994 acres in Malabar and 515 acres in South Kanara in the previous year.

The crop was affected by 'soft rot' in parts of Malabar and the seasonal factor in the District is estimated at 90 per cent. of the normal. On this basis, the yield is expected to be 3,630 tons of dry ginger as against 3,930 tons in the previous year. A normal crop is expected in South Kanara and the yield in that district is estimated at 180 tons of dry ginger.

Pepper—1938—Final report. The area under pepper in 1938 in the districts of Malabar and South Kanara is estimated at 102,800 acres (94,000 acres in Malabar and 8,800 acres in South Kanara) as against the final area of 104,081 acres (95,279 acres in Malabar and 8,802 acres in South Kanara) in the previous year.

The flowering of the crop is reported to be not very satisfactory. The seasonal factor is estimated at 80 per cent of the average in both the districts as against 90 per cent in Malabar and 95 per cent in South Kanara in the previous year. On this basis the yield is estimated at 7,900 tons (7,220 tons in Malabar and 680 tons in South Kanara) as against 9,120 tons (8,340 tons in Malabar and 780 tons in South Kanara) in the previous year.

The wholesale price of pepper per imperial maund of 82⅞ lbs. as reported from important markets on 9th January 1939 was Rs. 11-13-0 in Calicut, Rs. 11-6-0 in Tellicherry and Rs. 12-4-0 in Mangalore. When compared with the prices published in the last report i. e. those which prevailed on 5th September 1938, these prices reveal a fall of about 6 per cent in Calicut, 3 per cent in Tellicherry and 1 per cent in Mangalore. *(Director of Industries and Commerce, Madras.)*

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1938 to 20th January 1939 amounted to 542,501 bales of 400 lb. lint as against an estimate of 505,200 bales of the total crop of 1937-38. The receipts in the corresponding period of the previous year were 514,982 bales. 463,511 bales mainly of pressed cotton were received at spinning mills and 116,674 bales were exported by sea while 84,077 bales were imported by sea mainly from Karachi and Bombay.

(Director of Agriculture, Madras.)

College News and Notes.

Students' Tour. The second year B. Sc. students were on tour to the Southern Districts from the 3rd January and returned to the Headquarters on the afternoon of the 19th January. They visited Tindivanam, Palur, Nellikuppam, Aduturai, Tanjore, Pattukottai, Trichinopoly, Madura, Koilpatti, Dindigul and Kodaikanal.

Students' Club. Under the auspices of the Madras Agricultural College Students' Club, Sri. N. Subramania Ayyar delivered a very interesting and instructive lecture on " Federation " on 16—1—39. Sri. M. Kanti Raj, M. A., B. Sc. (Edin) presided. Before the proceedings commenced a condolence resolution on the passing of the Hon'ble Sri. K. Raman Menon was passed.

Cricket. A full day match between an All Coimbatore XI and the Agricultural College XI was played on 14—1—39 on the college grounds. The match ended in a draw. The college entering first, scored 258 (S. V. Srinivasan 92 not out, K. K. R. Menon 59, Mukundan 25. C. N. Babu 24). The Coimbatore XI made 151 for 3 when stumps were drawn for the day (Venkatachalam 60 not out, Kunhahmed 42, Suri 23 and P. S. Srinivasan 15 not out.)

New Year Honours We are glad to note that the Government have been pleased to confer the title of Rao Bahadur in the recent New year honours list on Sri. V. Ramanatha Ayyar, Cotton Specialsit. We congratulate him on his well-merited distinction.

Crickets Honours. We are glad that Mr C. Ramaswami, the All-India Test cricketer, was chosen to captain the Madras team against Bengal in the semi-final of the Inter-provincial contest for the Rangi cricket trophy.

Visitors. Rev. Father Robert Miranda S. J. of the Sacred Heart College, Madura visited the College and Research Institute on 8th December 1938.

Mr. F. J. Saunders, Director of Veterinary Services, Madras, accompanied by Mr. R. W. Littlewood, the Livestock Development Officer, Hosur, inspected the cattle farm and dairy herd on the 22nd January 1939.

Mr. Ariyant Manjikul B. Ag. of the Department of Agriculture, Siam, who was on a tour of the centres of agricultual research in India, visited Coimbatore on the 21st January. After visiting the Research Institute, central farm and cotton station Mr. Manjikul left Coimbatore for Travancore.

A Successful Co-operative Milk Supply Union. We are glad to publish the following extracts from the Inspection notes by the Joint Registrar of Co-operative Societies, Madras, on the working of the Coimbatore Co-operative Milk Supply Union, Ltd.

"The Board of Directors of the Milk Supply Union, Coimbatore have to be congratulated on the splendid work turned out against tremendous odds. Their progressive policy and untiring zeal have contributed in no small measure to the successful working of the institution which has begun to work at a profit, fully hopeful of wiping off before April 1939, the loss sustained at the early stages. There is ample scope for development and I hope the citizens of Coimbatore will not fail to respond to the call of pure milk and pure butter."

The late Sri P. Gopalarathnam.

It is with deep regret that we record the sad demise of Sri P. Gopalarathnam, L. Ag., Assistant, Cotton Section, who was recently promoted as Superintendent, Tobacco Research Station. Guntur. Sri Gopalarathnam was ailing from acute intestinal obstruction and his death took place on the 3rd January at the Government Headquarters Hospital, Guntur.

Sri Gopalarathnam was a loyal member of the Madras Agricultural Students' Union and has made several contributions to the pages of this Journal.

We offer our sincere condolences to the members of the bereaved family.

Weather Review—DECEMBER 1938.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·0	-0·7	42·2
	Calingapatam	0·0	-1·31	40·10
	Vizagapatam	0·0	-0·70	50·90
	Anakapalli*	0·0	-0·16	50·80
	Samalkota*			
	Maruteru*	0·0	-0·82	47·23
	Cocanada	0·0	-0·86	55·40
	Masulipatam	0·0	-0·72	32·10
	Guntur*	0·0	-0·10	34·50
Ceded Dists.	Kurnool	0·0	-0·25	23·50
	Nandyal*	0·0	-0·11	34·33
	Hagari*	0·0	-0·14	22·87
	Siruguppa*	0·0	-0·38	28·64
	Bellary	0·0	-0·08	23·40
	Anantapur	0·0	-0·17	29·40
	Rentachintala	0·0	...	28·70
	Cuddapah	0·0	-0·79	33·40
	Anantharajupet*	0·31	-2·51	23·81
Carnatic	Nellore	0·70	-2·58	30·40
	Madras	2·40	-2·95	26·50
	Palur*	1·82	-5·64	41·50
	Tindivanam*	0·99	-3·79	28·92
	Cuddalore	3·70	-3·94	33·90
Central	Vellore	1·30	-1·57	32·90
	Salem	1·00	+0·05	29·90
	Coimbatore	1·20	+0·12	12·70
	Coimbatore A. C. & R. I.*	0·74	-1·60	13·20
	Trichinopoly	1·90	-0·69	22·90

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	0·40	-10·50	48·10
	Aduthurai*	9·08	+0·55	35·57
	Madura	1·80	-0·18	28·30
	Pamban	5·50	-2·05	26·50
	Koilpatti*	4·17	+1·54	32·35
	Palamkottah	3·30	-0·67	30·60
West Coast	Trivandrum	1·60	-0·83	56·00
	Cochin	0·80	-0·90	87·60
	Calicut	0·10	-0·96	132·90
	Pattambi*	0·10	-0·81	87·93
	Taliparamba*			
	Kasargode*	0·0	-0·95	140·40
	Nileshwar*	0·0	-0·75	149·82
	Mangalore	0·0	-0·46	143·80
Mysore and Coorg	Chitaldrug	0·0	-0·30	21·20
	Bangalore	0·0	-0·50	31·50
	Mysore	0·40	0·0	19·40
	Mercara	0·90	-0·20	135·30
Hills	Kodaikanal	7·80	+3·40	54·10
	Coonoor			
	Ootacamund*	2·41	-0·93	40·12
	Nanjanad*	2·24	+0·37	35·90

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette

Except for a few light showers in southeast Madras, rainfall was in defect in the Presidency, and cool dry weather prevailed in the Peninsula. On the 6th a trough of low pressure appeared to the south-east of Ceylon causing rains in south-east Madras and as it persisted on 7th and 8th, it caused local rains in the south of the Peninsula. The North East Monsoon strengthened in Ceylon on the 24th and with it appeared unsettled conditions in the south-east of Arabian sea. On the 27th the North East Monsoon was active causing widespread rain in the south of Peninsula.

Skies were generally lightly to moderately clouded in the Madras Presidency and clear or lightly clouded in other parts of the Peninsula. Rainfall was in defect throughout, markedly so on the Coromandel coast.

Humidity except for a few days in the North Madras Coast was always in defect in the Konkan, Malabar and Southeast Madras.

The maximum temperature was generally below normal in the Madras Presidency and the minimum temperature was above normal.

Weather Report for Research Institute Observatory:

Report No. 12/38.

Absolute maximum in shade	...	88°F.
Absolute minimum in shade	...	58·7°F.
Mean maximum in shade ...	...	84·8°F.
Departure from normal ...	...	-0·1°F.
Mean minimum in shade ...	...	65·7°F.
Departure from normal ...	...	-1·1°F.
Total rainfall ...	...	0·74″
Departure from normal ...	...	-1·60″
Heaviest fall in 24 hours ...	...	0·50″ on 27th.
Total number of rainy days	...	2
Mean daily wind velocity ...	...	2·3 M. P. H.
Mean humidity at 8 hours ...	...	78·9%
Departure from normal ...	...	-0·8%

The weather was fine and moderately to heavily clouded throughout the month except during the last three days. Rainfall was in defect by 1·6″. The day and night temperatures and humidity were also below normal.

P. V. R. & J. C.

Departmental Notifications.

Promotions.

Substantive Promotions.

Sri. G. Ganapathy Ayyar, Permanent Assistant in Chemistry section from II Grade to I Grade. Rs. 225 to 250 with effect from 14-1-38.

Sri. S. Dharmalinga Mudaliyar, Permanent Assistant in Paddy section from III Grade to II Grade. Rs. 200 to 225 with effect from 14-1-38.

Sri. B. S. Narasimha Ayyar, Permanent Assistant in Chemistry section from IV Grade to III Grade. Rs. 120-10-170 to 200 with effect from 14-1-38.

Sri. C. Rajasekhara Mudaliar. Permanent Assistant in Paddy section from V Grade to IV Grade. Rs. 85-5-120 to Rs. 120-10-170 with effect from 14-1-38.

Provisionally Substantive Promotions.

Mr. Samuel Jobitha Rai, Permanent Assistant in Paddy section from II Grade to I Grade. Rs. 225 to Rs. 250 with effect from 14-1-38

Sri. K. Govindan Nayar, Permanent Assistant in Chemistry section from III Grade to II Grade. Rs. 200 to Rs. 225 with effect from 14-1-38.

Mr. C. M. John, Permanent Assistant, Oil seeds section from IV Grade to III Grade Rs. 120-10-170 to Rs. 200 with effect from 14-1-38.

Sri. T. Varahalu, Permanent Assistant in Chemistry section from V Grade to IV Grade. Rs. 85-5-120 to Rs. 120-10-170 with effect from 1st April 1938.

Transfers.

Name of officers.	From	To
Sri. K. M. Venkatachalam Pillai.	A. D., Kallakurichi.	Ground-nut Ware-house, Cuddalore.
„ Kuppumuthu.	Ground-nut Ware-house, Cuddalore.	A. D., Cuddalore.
„ E. Achyuthan Nayar.	A. D., Kallakurichi.	A. D, Gingee.
„ T. K. Mukundan.	A. D., Podanur Factory Area.	A. D., Cannanore.
„ T. Gopolan Nayar.	A. D., Cannanore.	F. R. S, Koduru.
Janab S. Varisai Muhammad Sahib.	Offg. Ass. Paddy Section.	Offg. Asst. in Mycology, Coimbatore.

Leave.

Name of officers.	Period of leave.
Sri. N. Raghava Rao, A. D., Narasannapet.	L. a. p. for 21 days from 23-1-39.
„ P. V. Hariharan, Asst. in Millets, A. R. S., Palur.	Extension of l. a. p. on m. c. for 1 month from 11-12-38.
„ K. E. Viswam, A. A D., Tiruvannamalai.	L. a. p. for 10 days from 3-1-39.
„ R. Anandapadmanabha Pillai, A. D., Nandyal.	L. a. p. for 55 days from 19-12-38.
„ S. Kuppuswami Ayyangar, A. D., Sriperumbudur.	L. a. p, for 4 months from 22-1-39.
„ K. V. Reddy Naidu, A. D., (on leave).	Leave on loss of pay on m. c. for 1 month and 23 days from 31-10-38.
„ T. G. Muthuswami Ayyar, F. M., A. R. S., Pattukottai.	L a. p. for 5 days from 3-1-39.
„ P. S. Narayana Ayyar.	Extension of l. a. p. for 1 month and 8 days from 24-12-38.
„ P. V. Subba Rao, Asst. A. D. (on leave).	Extension of l. a. p. on m. c. for 2 months from 15-11-38.
„ F. L. Daniel, Offg. Asst in Chemistry, Coimbatore.	L. a. p. for 31 days from 6-1-39.
„ C. S. Balasubramanian, Asst. in Entomology, Cuddapah.	L. a. p. for 3 days from 3-1-39.
„ T. Nataraj, Teaching Assistant.	L. a. p. for 1 month from 10-1-39.
„ K. Varadachari, A. D., Chingleput.	L. a. p. for 16 days from 10-1-39.
„ S. Ramachandra Rao, Asst. in Paddy, Buchireddipalem.	L. a. p. for 15 days from 6-1-39.
„ K. E. Viswam, Asst. A. D., Tiruvannamalai.	L. a. p. for 10 days and extension of l. a. p. for 15 days from 3-1-39.
„ S. Sangameswara Sarma, Offg. F. M., A. R. S., Anakapalle.	Earned leave for 14 days and extension of leave (without leave salary) for 30 days from 3-1-39.

Gazette Notifications.

Name of officers.	Period of leave.
Sri. Rao Sahib G. Jogi Raju, Asst. Director of Agriculture, Vizagapatam.	L. a. p. for 4 months and half average pay for 4 months and 26 days preparatory to retirement from 3—1—39.
Mr. A. C. Edmonds, Dy. Director, III Circle (old) Bellary.	Extension of leave on half average pay out of India for 8 days from 30-3-39.

Agricultural College & Research Institute, Coimbatore.

Additions to the Library during December 1938.

A. Books.

1. *Biodynamic Farming and Gardening.* Pfeiffer, E. (1938). 2. *The Soil and Social Reclamation.* Watson, G. C. (1938). 3. *Native Woody Plants of the United States: Their Erosion Control and Wildlife values.* Van Dersal, W. R. (1938). 4. *Bibliography on Soil Erosion and Soil and water conservation.* Gaines, S. H. (1938). 5. *The Land System in South India between 800 A. D. and 1,200 A. D.* Gupta, K. M. (1933). 6. *Third Conference on Cotton Growing Problems.* Emp. Cotton Grow. Crop. Pub. (1938). 7 *Poisonous Plants on the Farm.* Long, H. C. (1938). 8. *Simplified Market Research.* Coutant, F. R. & Doubman, J. R. (1938). 9. *The Theory and Measurement of Demand.* Schultz, H. (1938). 10. *The Study of Heredity.* Ford, E. B. (1938). 11. *Genetics.* Walter, H. E. (1938). 12. *More difficulties of the Evolution Theory.* Dewar, D. (1938). 13. *The Growth of Plants in relation to Cultivation (Cantor Lectures).* Tincker, M. A. H. (1938). 14. *Report on the Marketing of Eggs in India and Burma.* India Marketing Series No. 9. (1938). 15. *British Breeds of Livestock.* Eng. Min. of Agri. Pub. (1938). 16. *The Cattle Wealth of India.* Maniam, C. V. S. (1938). 17. *First Imperial Conference on Agricultural Co-operation.* (1938). 18. *Lectures and Conferences on Mathematical Statistics.* Neymen, J. (1938).

B. Reports Etc.

1. Administration Reports of the Madras Agricultural Chemist, Entomologist and Mycologist for 1937-38. 2. Report of the Agri-Horticultural Society of Madras for 1937-38. 3. Administration Report of the Electricity Department for 1937-38. 4. Annual Administration Report of the Madras Civil Veterinary Department for 1937-38. 5. Report on the Administration of the Department of Agriculture for the year ending 30th June 1937. 6. Progress Report of the Institute of Plant Industry, Indore, Central India for the year ending 31st May 1938. 7. Report on the operations of the Department of Agriculture, Burma for the year ended the 31st March 1938. 8. Annual Report of the Department of Agriculture, Mysore for the year 1936-37. 9. Report on the Administration of the Meteorological Department of the Government of India in 1937-38. 10. Plantation Crops: A summary of figures of Production and Trade relating to Sugar, Tea, Coffee, Cocoa, Spices, Tobacco and Rubber, 1938. 11. Twentieth Annual Report of the National Research Council, Ottawa for 1936-37. 12. Annual Report of the Department of Agriculture and Fisheries, Palestine for the year ending 31st March 1938. 13. The Report of the Department of Agriculture, Gambia for the period ending 31st May 1938. 14. Administration Report of the Director of Agriculture, British Guiana for the year 1937. 15. Annual Report of the Agricultural Experiment Station, Gainesville, Florida for the fiscal year ending June 30, 1937. 16. Annual Report of the Maine State Pomological Society for 1936—1938. 17. Fiftieth Annual Report of the Agricultural Experiment Station of Nebraska, 1937.

The Madras Agricultural Journal.

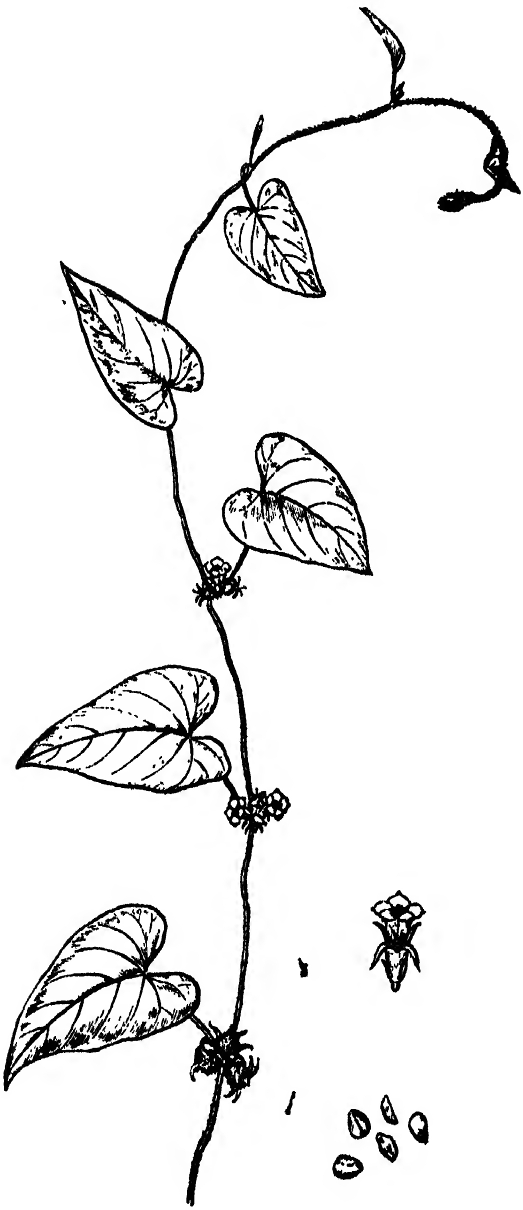
(ORGAN OF THE M. A. S. UNION)

Vol. XXVII.] FEBRUARY 1939 [No. 2.

EDITORIAL

Radio and Agriculture. The improvement of the lot of the peasantry is always a matter of great concern to those interested in agriculture. The Government had already introduced two beneficial measures of importance, i. e. Debt Relief Bill and the Prohibition Act which are calculated to give the peasantry a chance of better living in the long run. But we feel that something more can be done to enliven the peasant in his dreariness. Perhaps a word of solace or a word of cheer when given in just the time when he is in doubt and difficulty may go a long way in bettering his lot. It is here the "Akash-Vani" or the Radio could step in and accomplish what was not possible a few years ago. In the west where Radio has considerably advanced heart to heart talk is broad-casted to the peasants far and wide in specified periods, called the 'Farmers' hours.' In these talks information, on various subjects having a bearing on rustic life is given. With the establishment of more broadcasting centres in South India and the Government committed to the programme of installing the radio sets in select important villages it should be possible to benefit the ryot on similar lines. We understand that the Director of Agriculture is already on the move to institute a series of talks on agriculture. It is hoped that these and similar talks from the other sister departments will prove useful to the tiller of the soil.

The Public Health Bill. The passing of the Public Health Bill must be considered a step forward in awakening the Sanitary consciousness of masses It aims at improving the sanitary conditions of the village life with which the peasant is intimately associated. Hereafter the villager will be assured of a protected water supply by the Public bodies and consequently the danger in the shape of outbreaks of epidemics arising out of pollutions will be considerably reduced. This and other provisions of the Act are intended to improve the lot of the villager but a good deal of propaganda will be necessary to prepare the minds of the masses to accept the changes which are meant for their good.



Ipomea hispida Roem & Sch.

Ipomaea hispida, Roem. and Sch., A Useful Fodder Weed*

BY G. N. RANGASWAMI AYYANGAR, F. N. I., I. A. S.,

Millets Specialist and Geneticist, Agricultural Research Institute,

AND

N. S. RAJAGOPAL, B. Sc. Ag.,

Farm Manager, Millets Breeding Station, Coimbatore.

In response to the campaign against waste initiated by Mr. S. V. Ramamurti, I. C. S., Director of Agriculture, Madras, in December 1932, as part of a programme of utilising things noxious which can be made useful on a farm, a study was undertaken at Coimbatore to utilise the weed *Ipomaea hispida*, Roem. and Sch.

When growing horsegram (*Dolichos biflorus*, Linn.) this Ipomaea weed was found to be present in large numbers, growing more vigorous, leafy and drought resistant, covering the ground more fully and forming patches of fresh and green clusters in the midst of the drying horsegram crop. Horsegram is essentially a pulse of the famine country. It thrives well in sandy loams and in areas subject to drought. The presence of this vigorous weed naturally attracted attention. Seeds were gathered and a small crop was raised. It was not long before it was recognised that in this weed we had a good drought resistant fodder.

Ipomaea hispida is a slender, twining, annual, distributed throughout India ; stems clothed with hairs : leaves alternate, $1\frac{3}{4}''$ to $3''$ by $\frac{3}{4}''$ to $1\frac{1}{2}''$, ovate or ovate-oblong, acute, often apiculate, more or less hairy on both surfaces and with hairy margins, base cordate with rounded lobes ; petiole 1" long, densely hairy. Flowers 1—3 (rarely more in a head) ; peduncles very short, under quarter inch long : bracts $\frac{1}{6}''$—$\frac{1}{4}''$ long, linear, hairy ; pedicels very short. Sepals scarcely enlarged in fruit, very hairy, rather less than $\frac{1}{2}''$ long, acuminulate from an ovate base, the outer sepals broader than the inner. Corolla $\frac{1}{2}''$ long, companulate, pink, pubescent in the upper part with small tufts of hairs at the apices of the small acute lobes. Ovary densely hairy. Capsules $\frac{1}{2}''$—$\frac{1}{3}''$ in diameter, globose, hairy. Seeds glabrous, minutely pitted.

An enquiry was instituted about the occurrence of this weed in horsegram fields in other parts of the presidency and the following interesting information was obtained.

In many parts of the presidency this weed occurs in association with horsegram ; naturally the seeds of the former get mixed up with that of the latter at harvest time. This is known as *Kolikada, Palakada* and *Kollaganjeru* in the Telugu districts. In the Guntur district and in the *lankas*

* Paper presented to the 26th Session of the Indian Science Congress, Agricultural Section, Lahore, January 1939.

(islands in the river with thick deposit of silt) of the Kistna river, it is sometimes grown as a pure crop or mixed with horsegram and sorghum for fodder in small patches of about half an acre per pair of animals. The seed rate is about 20 lb. per acre. As a green feed for milch cattle it is highly valued. The Agricultural Demonstrator, Guntur, reported an instance in which a ten cent plot of this fodder plant was leased for Rs. 2 and fed green for one month to a she-buffalo at 20 lb. per day with a resultant increase in milk production. This crop is harvested in February and March. The weed is said to suffer from excessive rain. In the red loams of the Coimbatore district under rainfed conditions 3000 lb. may be cut as green feed and in the heavy black cotton soils of the Bellary district, a cut of 3000 to 3,700 lb. may be obtained. In the black soils of the Guntur tract which has a better distribution of rainfall, yields up to 4000 lb. per acre are recorded.

This was tried at Pattambi in the Malabar district along with horsegram and cowpea (*Vigna catjang*, Endl.). It was recorded that this Ipomaea was found to have a thick growth with tendrils trailing on the ground. Though the crop suffered in the north-east monsoon rains it rallied with the coming in of the dry weather. Ipomaea gave a forage yield of 7,962 lb. per acre as against 7,441 lb. of cowpea and 6,247 lb. of horsegram. One decided advantage noted in plots that had Ipomaea is that weeds were completely smothered and the plots were comparatively clean. As a mixture with teosinte, sorghum, or maize, the vines of this weed will have full facilities to grow and give a good cut along with the cereal forage. Its thick matted growth is a great help in making it a useful cover crop to check run-off water and soil erosion.

As in the case of horsegram the threshing of this crop has to be done by cattle. The *bhusa* (dried leaves, husk etc., left after the seeds are removed) is a useful by-product. The *bhusa* of horsegram has also proved a cattle feed. Two and a half pounds in the morning and two and a half lb. in the evening were fed to cattle continuously for three days and the animals relished it leaving very little behind. The seeds of this weed were kibbled and fed to cattle. They licked it up with avidity.

Fresh vines with flowers were analysed and found to be free from hydrocyanic acid. An analysis of a sun-dried sample of this fodder cut at the flowering stage was kindly made by the Government Agricultural Chemist. His findings are given below.

Heads of Analyses.	*Lab. No. 353/32—33.*
1. Original moisture	16·13
2. Ash	10·01
3. Crude protein	15·56
4. Ether extratives	2·40
5. Crude fibre	20·78
6. Carbohydrates	35·12
Total	100·00

7.	Insolubles...... ...	...	1·21
8.	Albuminoids ...	...	11·80
9.	Soluble mineral matter	...	8·88
10.	Starch equivalent ...	..	71·50
11.	Nutritive ratio ...	...	1 : 2·56
12.	Iodine	...	Nil
13.	Nitrogen	...	2·49
14.	Phosphoric acid ...	...	0·55
15.	Potash	...	3·05
16	Lime	...	1·62

Remarks. The sample of Ipomaea weed is a rich food containing 11·8% albuminoids and 35% carbohydrates. It is rich in ash having about 3% potash and 1·62% lime. It is as good as sunnhemp.

When the crop was ripe the seeds were gathered and the Government Agricultural Chemist kindly analysed the same and found it to be as follows :—

	Heads of Analyses.		*Lab. No. 476/32—33.*
			%
1.	Moisture	...	9·22
2	Crude protein ...	...	22·25
3.	Ether extratives ...	...	9·52
4.	Ash	...	3·94
5.	Crude fibre	...	10·63
6.	Carbohydrates ...	...	44·44
		Total	100·00
7.	Albuminoids ...	...	19·69
8.	Sand	...	0·11
9.	Soluble Ash	...	3·83
10.	HCN (hydrocyanic acid)	...	Nil

Remarks. The seed of Ipomea resembles the pulses in protein content; but it is much higher in fat, and free from hydrocyanic acid. In my opinion it will make an excellent food stuff.

From the above facts it will be noticed that in this hardy weed we have a fodder of high quality whose seeds are also rich in food value. The thick matting of this crop ought to make it a useful preventive of soil wash. This weed deserves greater attention and wider trial.

Summary. *Ipomaea hispida,* Roem. and Sch. is a weed commonly occurring in fields of horsegram (*Dolichos biflorus,* Linn.) This weed has proved to be a valuable fodder plant that is drought resistant. Cattle relish the fodder. The vines and seeds, on analyses show to be rich in fodder and food value. Acre yields up to 4000 lb. could be obtained. A botanical description of the weed is given. Its utility against soil wash is indicated. This weed deserves greater attention and a wider trial.

The Buffalo in the Madras Presidency.

By M. L. NARAYANA REDDI,

Agricultural Demonstrator, Palakonda.

While aiming at the improvement of livestock in this presidency, the production of suitable work-cattle is an important point to be kept in mind more than anything else. Different localities do require different kinds of work-cattle according to the environmental conditions, such as, soil, climate, rainfall, availability of water and nature of work they are required to do. In some areas, bullocks are more suited for draught purposes than buffaloes while under certain conditions, the buffaloes are more essential for draught purpose, as bullocks cannot perform the work equally efficiently. For instance, in the wet-land tracts of North Vizagapatam, East and West Godavary districts, Krishna, Trichinopoly, Tanjore, Tinnevelly and the West Coast districts (Malabar and South Kanara) the buffalo is more efficient and economic than the bullock in the main operations of puddling and levelling, not to speak of the cane crushing work and carting where these are required to be done. The buffalo as a draught animal, therefore, deserves in this Presidency, as much attention as the bullock, if not more; in as much as it is already established and approved of, that the she-buffalo is the common dairy animal for India by virtue of her high milk-yielding capacity and considerably greater content of fat in her milk than that of the cow. Though the buffalo plays such an important part in the economics of this presidency both as a draught and milch animal, it has not received as much attention as it should, in the matter of selection or evolution of suitable breeds or improving the local breed or breeds.

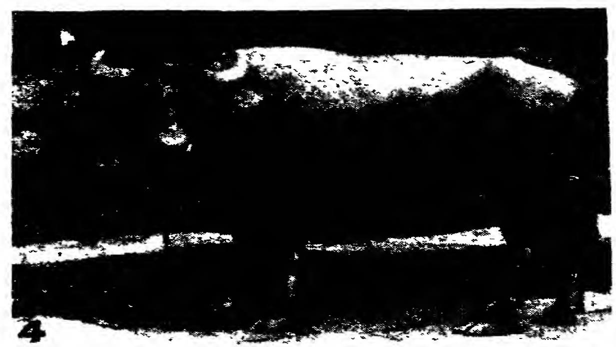
At present, what we find everywhere in this Presidency, is the *desi* or local buffalo. Even though in different tracts of this Presidency, the local buffalo is termed commonly as the *desi* buffalo the animals of one locality do not seem to possess the same characters as those of another locality. In fact, there is much variation in certain common features of an animal of one locality from those of an animal of other parts. In some tracts, the *desi* buffaloes go under the name of the tract itself, such as Guntur breed, Cuddapah breed, West-coast breed etc.

During the last two or three decades, four breeds of buffaloes from northern India and Central Provinces, have crept into this presidency, especially into the Northern Circars (excepting Guntur) chief of which being the Somabalpur-breed. These breeds are found to be superior to and more useful than the local from both work and dairy points of view, and as such, they are replacing the *desi* breed in the Northern Circars to a large extent, chiefly for draught purposes.

The following are some details regarding the chief characters and points of utility of these breeds. There are four chief breeds of buffaloes

Sombulpur.

Kalahand



that have come down from the North viz. (1) Sombalpur, (2) Kalahandi (3) Manda and (4) Zerangi.

The Sombalpur Breed. The Sombalpur buffalo is also termed as Gowdoo-buffalo or Kimedi buffalo. Its chief habitat is round about Bilaspur in the Central Provinces. Yearling calves are brought to the Sambalpur Agency in herds by *Gowdoo* (cowherds) where they are reared and sold to the dealers in Sambalpur, who take them annually to Vizagapatam, East and West Godavary, especially in the beginning of the south west monsoon.

Animals of this breed are dark in colour with a long barrel and of a huge size with short curved horns, bending backwards, running up and sloping forwards at the tip, thus forming a semi-circular appearance. This breed differs slightly from the famous Delhi-breed, in its long narrow barrel, elongated nose, flat fore-head and somewhat narrow horns. Generally, the neck of the animals of this breed becomes narrow after castration in greater proportion than that of the other animals and the front portion of the body is not well developed. This animal possesses considerably thinner skin in the majority of cases, when compared with other breeds; and it is more active and swifter in pacing. Its tail is narrow and long with a white tuft. Though the colour of the animal is generally black, brownish and ashy-grey animals are also occasionally met with. The length of an average male animal at the age of 4 to $4\frac{1}{2}$ years is 72 to 75 inches from crown to croup when the neck is not stretched, and the girth behind the hump is 90 inches.

The Sambalpur buffalo is not only famous for his heavy draught purpose, but also for his swift pacing on both slushy and hard soils alike, which quality is generally wanting in the other breeds. He prefers waterlogged places and marshy grounds both for roaming, grazing as well as for work. In places of heavy rain-fall, he thrives best and on rainy days he is found to graze better. This animal cannot withstand the hot sun, and in summer, it does not move out from the stalls between about 9 a. m. and 4 p. m. In this respect, this breed may be said to be more delicate than the other breeds and *desi* buffaloes. The animals are exceptionally docile for their huge size. and even young boys can control them. They require frequent dipping in water at least twice or thrice a day.

Sombalpur buffaloes are particularly useful for wet land operations and in deep slushy soils, they work with considerable ease. In the heavy delta soils of East and West Godavary, these are specially useful. The peculiarity with these is, that the animal maintains a uniform quick pacing even in slushy soils, with the heavy load of a *holla* or land-leveller. Being strong and sturdy creatures, they withstand the strain of hard work in puddling to a greater length of time than others, hence they are more economical for such work. Even for crushing sugarcane, these animals are found more useful specially on account of uniform swift pacing and capacity for working continuously for a longer period without getting exhausted unlike other animals. The writer found by trial, that two pairs of these could crush in five

hours, as much cane as three pairs of local buffaloes in the same period by turns. A pair of these animals can easily draw a load of 1,500 lbs. in a cart, and fare better than other kinds of buffaloes on sandy soils or slushy surfaces.

Of all the four breeds named above, this animal appears to be the best milker. I had experience with a stock of about 120 animals of this breed for nearly five years. Out of 70 she-buffaloes I selected a dozen good milkers, whose yields were recorded, to be 5,000 to 6,000 lbs. per head in a lactation period of 340 to 370 days, with a daily average of over 16 lbs. while the few best yielded 25 to 35 lbs. per day during the first quarter of their lactation period with moderate feed. I should think that under improved feeding, carefully bred and selected she-buffaloes should give considerably more yields.

Besides the good qualities enumerated above, this buffalo may be said to possess the advantages of being a regular breeder. Out of a herd of 70 she-buffaloes in the estate-farm of Parlakimedi, over 63 used to be served in October—November every year, and about 55 used to calve in the next August—September.

Animals of this breed require somewhat more care and better feeding than those of other breeds. But, they are certainly worthy of the extreme care and cost, being economical in the long run, in many aspects. The cost of feeding per pair per day is Re. 0—7—0 to 0—8—0.

Kalahandi Breed. This animal is named after its habitat in the "Kalahandi Samasthanam" of the Central Provinces. It is born and bred up in the Agency tracts of the above state and leads its life on the hills, and hence is much hardier than others. A few animals are annually brought down to Vizagapatam and occasionally to Godavari Districts for sale.

The animal, though also of a huge size, is short-barrelled when compared with the Sombalpur breed. The general colour is grey or ashy-grey, the fore-head being a little protruded. The horns are broad and half curved, running backwards and bending forward at the tip slightly and are broader and longer than those of a Sombalpur breed. The neck and front portion of the body are well developed with strong fore legs. The eyes are prominent and big with a narrow red margin around the eye-lids. The chest is large and well developed as in the Kangayams of the bovine cattle. The bony structure and ribs are very strong and enable the animal to take the strain even under heavy loads of any kind. The tuft of the tail is white generally, and the flanks are flat and broad.

The animal is a hard working docile creature but in the young stages appears to be timid. It withstands the sun and heat to a much greater extent than the Sombalpur and gets easily acclimatized to any locality. It feeds on the hardiest stuff, and is therefore an economical feeder when compared with Sombalpurs. It can graze on hard coarse grasses unlike the Sombalpur animal. Being much hardier, it does not require so much of

bathing and special attention as the Sombalpur animal. It is fit for a greater variety of conditions and localities.

The animal is specially suited for carting timber from the top of the hills to the plains, and for dragging heavy loads up-hill through rough roads on steep gradients with considerable ease and swiftness. He has a special knack of fixing its foot firm on the ground avoiding slipping on the steep inclines, or when about to slip down, to crawl on its knees for a few yards and getting up again.

In addition to possessing such special qualities for cart work on the hills, he is an equally suitable animal for work in the plains, both for puddling in wet lands and for sugarcane crushing. Though the animal is not so swift in his pacing as the Sombalpur in slushy soils, yet he works continuously for long periods without getting exhausted. He also withstands the sun better than other breeds and therefore is well suited even for dry tracts. The writer has not had much of personal experience with she-buffaloes of this type, but learns that the animal is not so good a milker as a Sombalpur, though a regular breeder and better milker than the local *Desi*-buffalo.

Manda Breed. Animals of this breed are brought down from the hills, bordering the Central Provinces towards the East. The animals are largely found in the hills between Central Provinces and Old Ganjam, especially Parlakimidi and Mandasa Agencies.

The manda buffalo is a medium sized animal smaller than the above types. It may be said, to be of the same size as a well developed *desi* buffalo. This breed is reared in the thick forest areas, and brought down to the plains for sale in large herds and hence the name manda (herd) buffalo.

The general colour of the animal is brown or grey. The horns are broader and running backwards exactly like the *desi* buffalo's horns, in a semi-circular way. The eyes are sharp with a broad red margin around the lids. The nostrils and jaws are wide and more prominent than those of other buffaloes. It is sometimes ill-tempered before arriving in the plains, but later on, it gets fairly docile. The fore legs are stout and short, and the chest is well-developed, the neck also being short and stout. The nose is very short with a flat fore-head and there is an arch-like curved red ring around the chest about 3 inches wide. The collar bones and ribs are very stout for its size. The fet locks and front knees have yellow rings of hair, and the tuft of the tail is yellowish white unlike those of any other buffalo. The size of a 6 teeth animal (male) is as follows: Length from crown to croup 65 inches, girth 77 inches and height 52 inches.

The manda is a hardier animal than the Sombalpur and withstands the sun like a bullock. In short, this has got all the qualities of a Kalahandi animal, though to a less degree. It can manage with limited feed, and grazes on hard pasture. It is more economical to maintain a pair of these, than in the case of Sombalpur or Kalahandi, considering the amount of

work turned out, with reference to the expense of maintenance, or in other words greater amount of work can be extracted with less cost by owning these buffaloes. The cost of feeding per pair per day works up to Re. 0—4—6.

The manda buffalo is useful for all agricultural operations, being moderately swift, and drawing heavy loads in much greater proportion to its size. It gets easily acclimatized to any locality and thrives well under varied conditions. It is nick-named in the agencies as *Bolodo-pudo*, (bullock-buffalo), due to its being capable of doing hard work in the hot sun, as a bullock does, for a great length of time. Its usefulness for carting stones, timber and other heavy loads is a special feature of this breed. It can draw a load of about half a ton even in country tracts, though at a slow pace. The milk yield is said to be the same as that of a good *desi* buffalo.

Zerangi Breed. This breed is found in the agencies of Zerangi hills in the old Ganjam agency, and hence the name. It is the smallest of the buffaloes, even much smaller than the *desi* buffalo, but a swift runner and more energetic than others for its size.

The Zirangi is a black-coloured small animal, not exceeding $3\frac{1}{2}$ to $3\frac{3}{4}$ feet in height, with a short barrel. The animal has short nose and small cut-horns running backwards like those of a small sized *desi* buffalo. The tail is peculiarly thin and short, about $1\frac{1}{2}$ feet long being cut away in the early stages. The hooves have a slight slender cut in the middle, and appear almost like unseparated ones. The skin is considerably thinner than that of other buffaloes which is indicative of its activity and swift running.

Being habituated to live in the midst of wild beasts this animal gets frightened and alarmed at the slightest noise. The hooting of a motor car or a bus scares the animals and the cart may even be upset but with a nose string and head-rope it can be easily brought under control after 2 or 3 months' training. On account of their swift running and small size, they are sometimes called 'deer-buffaloes' in the hills of Zerangi and Parlakumidi agency. They withstand the heat only to a certain extent.

The Zerangi buffaloes are very useful for the wet-lands with light soils, such as those of the west-coast districts. It is their natural habit to go swiftly while ploughing and carting. For their size they draw heavy loads and are generally considered hardy animals. They are more suitable for the plough, than for the cart though a pair can easily drag a load of 1,000 lbs. in a cart.

Being a small animal, the Zerangi buffalo can manage with considerably less quantity of feed, and may be said to be the most economical feeder for the amount of work turned out. The cost of a pair would be from Rs. 60 to 70, according to size, and a poor cultivator can maintain these with much advantage on account of their low price, small maintenance charges, and useful service. These are not, however, found very useful for cane crushing work, as the Sombalpurs, though some pairs are seen to work very satisfactorily at a poor man's small cane mill.

At present these are found only in the northern taluks of Vizagapatam district and west of Ganjam and have not yet been taken to other parts. The writer has no experience of the female stock, but it is reported that the she-buffalo of this breed is just as good a milker as the *desi* buffalo.

The writer has attempted in this article to briefly describe the good and bad points of four existing breeds with the hope that an attempt will be made to select suitable animals and to establish a foundation herd for future breeding.

Tobacco Stems as a Useful Source of Nicotine for Insecticidal Purposes

BY M. C. CHERIAN & M. S. KYLASAM,
Agricultural Research Institute, Coimbatore.

Introduction. The study of insecticides and their toxic action on various harmful insects forms one of the many important items of the work of the Entomological Section. It has always been its endeavour to explore the possibilities of finding cheap and efficient insecticides the cost of which would be well within the means of an average ryot to meet. The authors' chief object in writing up this short paper is to focus attention on the possibilities of tobacco stems being used successfully as a source of nicotine for ordinary spraying purposes against some of our orchard and vegetable pests.

Nicotine and its sources. To an entomologist the value of tobacco lies in its high nicotine content. Nicotine is an alkaloid that is formed during the fermentation process in the tobacco leaves; it is distributed in various parts of the plant, i. e., leaves, stalks and stems in varying proportions. Leaves contain the maximum; the stalks and stems have it in very small proportions. Various types of tobacco have varying nicotine content. The leaves of the local tobacco popularly known *Yerumai Padaku* has been found to contain as high as 6·08% of nicotine against 3·26% in Virginian types like Harrison's Special. The use of high grade tobacco leaves as a source of nicotine is out of question as it can never be a commercial success in spraying operations.

Action of Nicotine. Nicotine is a very powerful toxic agent; it is a fumigant and owes its success to its power to paralyse the nerve centres by entering the spiracles of the insects on which it is sprayed and bring about their death ultimately. It is never used at the full strength but is always diluted either with water or dust to carry a known percent. Western countries have been rigidly insisting that the *final* spraying fluid should contain not less than 0·05% to 0·1% to obtain satisfactory results. But our trials show that lower strengths of nicotine can be recommended to give the *same measure of success.*

Nicotine of the market. Pure nicotine 98% is available in liquid form and is imported from foreign countries at Rs. 18 to 21 per lb. Besides, there are proprietary dusts containing 3 to 4 percent nicotine. Nicotine sulphate is another liquid containing about 40% nicotine available at Rs. 4/8 per lb. All these are exceedingly costly to be recommended for use by Indian ryots.

Tobacco stems. It is the usual practice to use tobacco waste for spraying purposes. Now, we find that tobacco stems could be used for the same purpose at less cost. It is estimated that an acre crop of tobacco might give about 400 lbs. of stems which are either wasted away or burnt as fuel or dumped into the manure pit by ryots. But seldom are the stems used as a source of nicotine. The useful alkaloid in it is thus totally lost. On a rough estimate 400 lbs. stems will be able to give enough nicotine to make up about 1200 gallons of spraying fluid of the required strength. This quantity should be sufficient to treat a 12 acre chilli crop against thrips or tobacco against plant lice. Ordinarily, a ryot is known to spend Rs. 6 per acre to get the requisite tobacco waste. It is presumed that with the use of stems instead these charges could be reduced much to the advantage of the ryot.

Water Extracts of tobacco stems. Three different water extracts were made. One was a cold infusion prepared by soaking one pound of chopped stems in one gallon of rain water overnight and draining it after 12 hours of soaking. The other two are hot infusions; one prepared by boiling one pound of the stuff for 15 minutes and the other for one hour. All these extracts were finally made upto one gallon and tested at various dilutions against aphis and thrips; a small quantity of soap ¼ oz. to one gallon was always added to increase its wetting powers.

Tobacco Stems Infusions and their analyses for nicotine. Through the kindness of the Government Agricultural Chemist and his staff, it was possible to get the stems of the local tobacco and the water extracts analysed for their nicotine contents. From Table I which gives the analysis of tobacco stems and their water extracts, it will be seen that rain and tap water extracts have given more or less similar nicotine values; further, with the lapse of time, i. e. four months, a decrease in the nicotine values is noticeable which may be due to a spontaneous, slow loss of nicotine from the stems under storage conditions.

Toxicity trials. Toxicity trials were made on *Aphis gossypii* Gl. to test the toxic values of the extracts at various dilutions. All the three above extracts were sprayed at the original strengths and at dilutions of 1:1, 1:2, 1:3 on the aphis under field conditions and mortality counts were taken nearly six hours after the spraying. It was found (Table II) that the cold and one hour boiled extracts gave 97 to 100 per cent kill even in the lowest dilutions tried. This incidentally indicates that nicotine, at as low strengths as 0·018, is quite efficacious against the plant lice and higher

nicotine content is not essential. It is interesting to find that long boiling for one hour gives increased nicotine values in the extracts over those boiled for less time.

TABLE I. Analysis of tobacco stems and their water extracts for nicotine.

Date of analysis.	Nature of water used.	Cold infusion	Hot infusion		Tobacco stems used for preparing infusions.
		1 lb. soaked in 1 gl water overnight for 12 hours.	1 lb. immersed in 1 gl. of simmering water for 15 mts.	1 lb boiled in 1 gl. of simmering water for one hour	
		grams in 100 cc. Sol.	grams in 100 cc. Sol.	grams in 100 cc. Sol.	
31—3—1938	Rain water	0·086	0·055	0·070	0·1433
4—8—1938	Rain water	0·051	0·043	0·047	not done
	Tap water	0·051	0·039	0·051	...

TABLE II.

Toxicity trials of tobacco stems infusions against *Aphis gossypii* Gl. made on 29-3-38.

Strength of solution	Mortality of Aphis*				Nicotine values per cent		
	Cold infusion	Hot infusion boiled for 15 minutes	Hot infusion boiled for one hour	Control (water)	Cold infusion	Boiled for 15 minutes	Boiled for one hour.
Stock solution	100%	98·1%	100%	7%	0·086	0·055	0·070
1:1	98·1%	97·2%	100%	—	0·043	0·027	0·035
1:2	100%	94·4%	95·2%	—	0·028	0·018	0·023
1:3	100%	42·1%	99·8%	—	0·021	0·013	0·018

* Includes the values for the moribund as well.

Similar trials were made against the chillies leaf curling thrips *Scirtothrips dorsalis* Hd. using only the cold extract, in December 1938. The aqueous infusions were found to be highly toxic in dilutions of 1:2 and a decrease in toxicity was noted when the dilution was raised to 1:3. As in the previous case, the counts were taken six hours after the spraying was done and the results so obtained are given below:

Stock solution	(0·051%	nicotine)	gave	97·2%	mortality.	
1:1	(0·025%	„	)	„	90·2%	„
1:2	(0·017%	„	)	„	97·1%	„
1:3	(0·013%	„	)	„	65·9%	„

The aqueous extract, even at dilutions of 1:3 was found to be very effective against the ragi root aphis *Tetraneura hirsuta* B, the lab-lab aphis *Aphis medicagenis* K and the brinjal aphis.

Analysis of the various varieties. In view of the possible increase in the use of tobacco and its products in the insecticidal sprays, it was felt necessary to know which of the varieties grown in this Presidency gives the maximum nicotine value. This information might be useful in selecting the type with a high nicotine content, for growing on a large scale, when the need should arise in the future for an extensive cultivation of tobacco for insecticidal purposes.

The leaf samples from the current year's produce were obtained through the help of the Assistant Directors of Agriculture and were kindly analysed for their nicotine content by the Government Agricultural Chemist. The analysis as furnished by the Chemist is given below. It will be seen that the *Yerumai Padaku* grown at the Central Farm records the highest percentage of 6·08% as against 1·851% of *Javari* from Bellary. Between the two range the values of other tobacco.

TABLE III.

Results of analysis of 17 samples of tobacco leaves for their nicotine content.

Serial Number.	Variety.	Source.	Nicotine value in per cent.
1.	Yerumai Padaku	Central Farm	6·080
2.	Kanuvakkarai	Avanashi	4·906
3.	Dakshinadi	Guntur	4·290
4.	'Oosikappal' for chewing	Bhavani	4·183
5.	Perumathai (for chewing)	Do.	3·753
6.	For chewing and beedi	Hospet	3·734
7.	For chewing	Dindigul	3·409
8.	Harrison Special	Guntur	3·206
9.	'Oosikappal'	Coimbatore	3·109
10.	For chewing and snuff	Siruguppa	2·868
11.	—	Adoni	2·850
12.	Snuff tobacco	Dindigul	2·746
13.	'Local' (sun cured)	Guntur	2·672
14.	'Cheroot'	Dindigul	2·672
15.	'Lanka' for cigar	Rajahmundry	2·221
16.	'Oosicappal' (for country cigars)	Bhavani	2·147
17.	Javari	Bellary	1·851

Acknowledgments. The authors' thanks are due to the various Assistant Directors of Agriculture for help in sending tobacco samples and to the Government Agricultural Chemist for kindly getting the analysis done.

Bridging the Gulf.

BY G. MAHADEVAN, B. Sc. (Ag.)

I have chosen rather an enigmatical title for my paper from the cue given by Sir John Russell in his Report on Indian Agriculture. This latest document prepared at the instance of our Agricultural Viceroy practically ends with this phrase, making everybody who goes through the report to think furiously as how best to bridge the gulf between the research station and the ryot over waters of the conservatism of the Indian agriculturist.

Several reports on Indian agriculture have paid high tributes to our research sections. Our research on agricultural problems and their useful solutions thereon can compare favourably with what is done elsewhere. Yet the Indian ryot has not derived the benefit and continues to be the poorest in the World. Here then is the enigma ; our research is of a high order and the Indian peasant for whom all this research is intended is none the better off in the World and has barely "an anna and seven pies income per day". This is the gulf that exists between ourselves and the objects at which we aim. We find we have better agricultural knowledge to impart to the ryot, but at the same time we see that the ryot is not taking up our suggestions for improvement.

There are several reasons for the existence of the gulf. And it has ever been the feature of several reports on Indian agriculture to number them in the order of importance. The chief reason attributed in one and all of them is the conservatism of the ryot. The peasant is proverbially conservative all the World over. And there is nothing special in the Indian peasant being conservative. The man who tills the soil and makes a living by the hard manual labour feels chary to adopt any method which is reported to be an improvement over his time-honoured practice, whether he be the poor Indian peasant or the innocent Chinese cultivator, the shrewd Japanese agriculturist, the proud German tiller of the soil or the clever English yeoman. They are all conservative. To every one of them it is positive risk to change one's time-honoured practice. Still there does not seem to be the same big gulf which we have before us in India. Solutions offered by the research stations in the European countries particularly are more easily adopted by the peasants of those countries than our own Indian peasants. Sir John Russell's report explains this contrast at length. If in Europe one of the research stations discovers a method which is an improvement over the time-honoured method it is followed by the European agriculturist comparatively quickly and without even the inducement from the Government of the country. Here in India such ordinary things as the Cotton Pest Act requires years of propaganda before it is brought into practice. This is a peculiarly baffling affair which gives room for people to talk of the existence of the gulf between the research station and the ryot,

Sir John Russell attributed this slowness and sometimes positive refusal on the part of the Indian peasant to adopt better methods of agriculture to the lack of cultured classes taking to agriculture as a profession. This he is not tired of repeating at every stage of his report. A cultured man has better discrimination. And when he takes to agriculture as a profession even though he be surrounded by peasants who are conservative, he, with the power to discriminate, follows the method that stands to reason. Naturally his neighbours who are less cultured than himself closely observe his methods and eventually get convinced about the superiority of the same. The custodians of the culture of society have got to be also the promoters of the better agriculture of the land if there is to be an improvement of Indian agriculture. If a few cultured people could be induced to take to agriculture as a profession this gulf between the research station and ryot would narrow down and eventually disappear. If the problem of inducing the cultured classes to settle down on the land is solved there is good chance for Indian agriculture to forge ahead.

Let us then consider the variety of material available for bridging this gulf. Tried and tested material is certainly the best for any construction. On a close analogy it might appear that people who have gained considerable experience in Indian agriculture while in the department are the best people to settle down on land and successfully practise agriculture and be the beacon lights for others to follow. This apparently seems to be the best method of solving the problem. As many, if not all the members of the Agricultural Department should settle down in villages and put into practice the improved methods of agriculture and show their worth. That the retired officers of the department should settle down in the villages seems to be apparently most reasonable. If they are ill suited for this kind of work by reason of their age and moreover the change-over in the normal life that it will entail is sure to make them go off the bearings. They will in fact be misfits. We must naturally think of some other agency to take up the bridging.

There are certainly some exceptions to this general trend of things concerning retired people. In our own province Rao Bahadur Ramaswami Sivan is now busy with his Chidambaram colonization scheme. We want gentlemen of this type to lead us. And it should be the duty of the Government to help such schemes and encourage retired gentlemen to come forward and lead the younger generation. Let us also wish that more and more retired gentlemen will come forward with schemes like this. Perhaps young gentlemen in service could undertake this. I raise this point most cautiously. I very well remember the vehement protest that was raised by the officers in service when we discussed this problem in a debate in this college. The proposition was that "Agricultural Officers after 5 years service in the Department should be made to settle down on the land". Of course the students then had a motive in supporting this proposal as it gave them a hope to have a footing in the Department soon after graduation. But I do not see anything seriously wrong with the proposal. If this be the

case why should they object to practising it themselves. This is one of the strongest arguments advanced by the Indian ryot before accepting any methods suggested by the Department. There is a feeling that, if the much talked of improved methods of agriculture could be successfully demonstrated by the officers themselves in the lands on which they settle, much of the apathy of the ryot for the improved methods would vanish. He will get more interested in them and slowly adopt them.

Gentlemen might remark that this is all an idealistic talk carrying no practical suggestions. Let me give a few instances. Supposing one of our specialists, say, the Oilseeds Specialist evolves a certain strain of groundnut and would have us all believe that it gives an increased return of say Rs. 12—8—0 per acre to the cultivator the Government resolves to ask this Specialist to settle down on a piece of land extending in area which when multiplied by the enhanced return per acre will equal his salary the Specialist can easily take up the challenge and prove that his statements are true to fact. He should be able to substantiate his claims, if, in lieu of his monthly salary he were allotted as much of land to cultivate as would give him an amount equal to his annual salary based on the increase in yield.

Some gentlemen with an alarmist tendency might say that this is all positively risky to resign a job and settle down on land. At least I know one instance personally where an officer of the Department is much better off as an agriculturist in Scotland than as a Deputy Director of Agriculture. You might have known of several more instances and the proposition that agricultural officers after a few years service should settle down on land is not so bad as certain gentlemen would have it represented. And if a few of our agricultural officers should actually do so it will effectively answer some of the critics who do not have much of faith in the sayings of the Department.

Lastly, we come to the agricultural graduate as the material for bridging the gulf. He is about the freshest material we can think of. The new graduate is eminently fitted to take up to private farming but unfortunately he has not been trained to that frame of mind. As a result, we are not able to secure his services in this direction.

The chief reasons that dissuade agricultural graduates from taking to private farming are that his parents and elders frighten him about the risk-involved and they had looked upon his education as the safest means to secure a job after graduation. It is a sad feature that he is unable to get the job he had hoped to get and finds himself thrown out of gear. At present a lot of talent is simply running to waste. It is hoped that in course of time the young graduates may veer round and develop a frame of mind conducive to private farming and take it up for making his living. Then are the chances more bright for the closing down of the gulf that now exists.

If at this stage I might be permitted to join my young friends I would ask one and all of them to think whether the practical training we receive

and the outlook on life we acquire in colleges like ours are only mere qualifications to secure jobs. Surely they are worth much more. It is the way with our elders to frighten us with things which they themselves dare not face. But we are all young men with plenty of warm blood in us and it is unbecoming of us to talk of risk and all such silly things when the whole country is marching forward constructing one bridge after another. We, as the best material for bridging this gulf of rural conservatism, shall not lag behind any others in the service of our country and humanity at large. I would appeal to my young friends to take to private farming, come what may, and be leaders of agriculture of our country. As I make this appeal I am conscious of the fact that I am asking my young friends to choose a rugged and steep path to climb the hill. It is certainly a hard life to be a private farmer. But you can always be proud of choosing the right path. It is true we have not received any encouragement from the Government in the past as I might testify in my own case. But now the whole thing is changed. We are now having a popular Government with the broadest vision and the most sympathetic outlook. It is up to us to take the best advantage and serve the country in bridging this gulf between the research station and the ryot.

To sum up in conclusion all that has been discussed in this short paper the most serious problem in the development of Indian agriculture is the gulf that exists between the scientific knowledge and the applicability of the same by the Indian ryot who continues to be the poorest in the World. The one way of solving this problem according to the best authority and for the most convincing reasons is that cultured people ought to take to agriculture as a profession as the only means of overcoming the conservatism of the ryot and forming the bridge between himself and the culture he had attained. Old and retired people are generally no good at this. But there are a few unique exceptions and it shall be the duty of every one of us to wish them all success and make our Government to help and support these gentlemen. People in service who could undertake this are certainly very good material and every attempt must be made to induce as many of them to settle down on the land and put into practice what they have been advocating. The finest material however is the agricultural graduate who deserves better encouragement both from our elders as well as from the Government. These are some of my humble suggestions in the construction of this bridge over the gulf of the conservatism of the Indian ryot.

EXTRACT

Hydroponics or the systematised raising of crop and ornamental plants in water culture is the subject of an interesting article by C. T. Greeves-Carpenter in the January number of *Scientific American*. The plant physiologist and the research worker have long been familiar with the technique of growing plants in nutrient solutions in the absence of soil, but their efforts have been solely confined to the laboratory. The adaptation by Dr. W. F. Gericke of the Univeristy of California of this method has transformed it from an experimental curiosity to a commercial proposition. Nor need horticultural enthusiasts working in city offices and living in tiny flats any longer envy their suburban colleagues their freshly fragrant button holes, for hydroponics offers " a fascinating means of achieving their objective in a small space such as on window sill, or where there is a lack of soil as would be the case in the limited confines of a roof." Under the system, the nutrient solution is contained in tanks of wood, concrete or asphalt coated iron. A tank $2' \times 6' \times \frac{1}{3}'$ will conveniently hold about 25 gallons of solution. An asphalt painted " mattress " of wire mesh (1" for small plants and 2" for larger ones) are stretched on fixed uprights at a height of 3" above the surface of the nutrient solution and a layer of straw is spread thereon. The top layer is made up of fine inert material like sawdust, pine shavings etc. The thickness of the bed of litter and sawdust is determined by the nature of the plant to be grown thereon. When plants are to be raised from seed a 2" layer of litter will suffice; the bed is moistened with water, the seeds are broadcast and lightly covered. When cuttings, seedlings or bulbs are transplanted a 3" to 4" depth of bed is desirable. All plants, seedlings, etc., should have their roots down the litter and wire mesh so that they are immersed in the nutrient solution. It is important to see that a constant level of the nutrient solution is maintained in the tank. Frequent aeration of the solution is necessary. It is also advisable to change the solution at least once a fortnight. The composition of the nutrient solution is such as to supply all the elements required for proper plant growth, and accordingly varies from plant to plant. Other factors like the acidity or alkalinity of the water used, climatic conditions etc have also to be considered. The author gives some formulae and also full instruction for preparing the various nutrient solutions.

It is not however claimed that hydroponics produces better plants or larger yields than those grown under favourable soil conditions.

Gleanings.

A new milking process. A new milking process, in which air is excluded from all steps, all the way from cow to bottle, has been invented by Burgess A. Lee of Lockport, N. Y., working in collaboration with Professor Oscar Frif., of the Ohio State University. Milk obtained by this process is claimed to be protected against losses of calcium and vitamins that occur when the fresh-drawn milk is exposed to air.

Milk as it comes from the cow's udder contains two gases in solution, nitrogen and carbon dioxide. Contact with oxygen is stated to cause precipitation of calcium salts and loss of vitamin constituents. This loss, according to Professor Frif, is responsible for the failure of pail-fed calves to thrive as well as their udder-fed companions. Exposure of milk to air is aggravated in the cooling process of present dairy practice, where it is flowed openly in a thin sheet over chilled pipes. (*Science* Vol. 88 No. 2287, October 28, 1938.)

A new Synthetic Fiber. Chemistry has created a new synthetic fiber from coal, water and air, which has the strength of steel coupled with the fineness and beauty of silk, it is announced by the E. I. du Pont de Nemours and Company. The new fiber, claimed to be one of the greatest achievements of industrial research, is expected to be the rival of natural silk in its last remaining stronghold of usefulness—the hosiery trade. Nylon is the new material from which the new fiber is made It is basically different from familiar rayon in that it does not require cellulose for its production.

Chemically the nylon fibers are polyamides. Like natural silk they have a protein like structure Filaments finer than silk or rayon can be spun The filaments have amazing elastic recovery and great strength. These properties plus the ability of the fibers to take common dyes easily, forecast the chemists goal of making sheer, two-thread hosiery with the wearing characterstics of the four-thread, service-weight variety.

But hosiery is not the only application of the new nylon fiber. Because its diameter can be controlled at will it can be produced for a variety of products like brush bristles, racquet strings, fishing lines, woven dress goods, velvets, knitted and woven underwear. It can also be employed as a transparent wrapping film, for plastic compositions, textile finishing agents and coated fabrics. Tooth-brushes with the synthetic bristles are already on the market. (*Science*, Vol 88, No. 2288, November 4, 1938).

New Wood Preservative. Pentachlorophenol, now produced on a commercial scale, has been found to be a particularly effective material for the treatment of wood for preserving it against decay, termites, and other destructive forces. It may be applied as a 5 per cent solution of a petroleum solvent, preferably by pressure impregnation or by brush treatment The advantage of the new chemical as compared with creosote and other familar materials is that it does not change the texture or painting properties of the wood and possesses practically no odor. It can be used for treating heavy timbers or for the preservation of finished mill work. Although it is difficultly soluble in water, it forms a compound of sodium which is readily soluble and can be used for controlling slime and algae in industrial water supplies and as a preservative for glue and other similar materials subject to decomposition by bacteria or fungi. D. H. K. (*Scientific American*, January 1939)

New Insecticides. British research on chemicals for the control of pests has revealed the fact that several unusual compounds ordinarily used for other purposes possess merit for controlling insects. Tetramethylthiuram sulfide, a valuable accelerator in rubber vulcanization, repels the Japanese beetle. Methyl bromide has been found to be even more toxic than hydrocyanic acid for several types of moths and larvae and is being used effectively against granary weevils. Phenol thiazine is being studied as a substitute for lead arsenate. Dichloroethyl ether, used as a solvent in refining petroleum, has been found effective in killing the wire worm.—D. H. K. (*Scientific American* January 1939)

Death Ray for Insects. Cold-Blooded inhabitants of the fur of dogs and cats, of birds and their cages, lofts, and coops—fleas, ticks, lice, red mites—now have their own private death ray A new infra-red lamp, developed by the Leray Corporation, kills all such vermin and others which infest seeds, cloth, wood, and other materials. Fungus is also said to be susceptible to its killing rays, so that plants may be freed of disease fungi.

At present most of the emphasis on the killing power of this light is being placed on its use to rid household pets of vermin. Abercrombie and Fitch Company, New York sporting goods store, advise that they are daily making

very satisfactory demonstrations on dogs that are brought into the store. One treatment, naturally, is not sufficient to eradicate all vermin on an animal. The reason for this is not that all pests on the pet do not succumb at once but because the vermin often leave their "hosts" for short periods, especially after they have eaten well and are sleepy The pet is therefore used as a lure or trap to facilitate cleaning of its quarters.

The Leray lamp is as easy to operate as a flashlight. It is held close to the animal's body, while the operator's other hand ruffles the fur so that the light will penetrate to the skin That is all there is to it except that often it is necessary to accustom the animal to its presence by flashing it on for several short periods. Death to vermin at any particular spot comes in from a fraction of a second to four or five seconds. (*Scientific American*, January 1939.)

Crop and Trade Reports.

Paddy—1938-39—Final forecast report. The average of the areas under paddy in the Madras Province during the five years ending 1936-37 has represented 14 5 per cent of the total area under paddy in India.

The area sown with paddy in 1938-39 is estimated at 9 943 000 acres as against 10,043,000 acres for the corresponding period of the previous year and the finally recorded area of 10,140,831 acres in 1937-38. The present estimate falls short of the final area of the previous year by 2 per cent and of the area of 10,200,160 acres in a normal year by 2 5 per cent.

963 000 acres have been reported as sown since the last December forecast was issued. The extent so sown was large in the South (326.000 acres), the Carnatic (200,000 acres), East Godavari (100,000 acres), Anantapur (65,000 acres), Vizagapatam (60.000 acres) and Chittoor (56,000 acres). The area sown in December and January was less than that sown in the corresponding period of the previous year by 485,000 acres or by 33 5 per cent

The area under second crop paddy is expected to be below normal owing to the failure of the North-East monsoon rains.

The harvest of the main crop of paddy is in progress.

The crop was damaged by the cyclone in November in the districts of East Godavari, West Godavari and Kistna. The crop was also adversely affected by the failure of the North-East monsoon rains in the other important paddy growing districts.

The yield is expected to be normal in Bellary and Anantapur and below normal in the other districts. The yield is estimated to be only 50 per cent. of the normal in Chingleput and South Arcot, 60 per cent. in West Godavari and 75 per cent. in North Arcot and Ramnad. The seasonal factor for the presidency works out to 82 per cent. of the average as against 96 per cent. in the Season and Crop Report of the previous year. On this basis, the yield works out to 81,145,000 cwts. of cleaned rice This represents a decrease of 15,851,000 cwt. of cleaned rice or 16·3 per cent. when compared with the estimate of 96,996,000 cwts. of cleaned rice in the Season and Crop Report of the previous year. The yield in an average year is estimated at 102,007,000 cwts. of cleaned rice.

The wholesale price of paddy, second sort, per imperial maund of 82⅖ lbs. or 3 200 tolas as reported from important markets on 6th February 1939 was Rs. 3—6—0 in Vellore, Rs. 2—12—0 in Chittoor, Rs. 2—10—0 in Tinnevelly, Rs. 2—9—0 in Virudhunagar, Rs 2—6—0 in Vizianagaram and Madura, Rs 2—5—0 in Rajahmundry and Trichinopoly, Rs. 2—4—0 in Ellore, Bezwada, Masulipatam,

and Guntur, Rs. 2—2—0 in Cocanada and Cuddalore, Rs. 2—1—0 in Hindupur and Conjeeveram, Rs. 2—0—0 in Kumbakonam and Anantapur, Rs. 1—15—0 in Mangalore and Rs. 1—14—0 in Negapatam. When compared with the prices published in the last report, i. e., those which prevailed on 9th January 1939, the prices reveal a rise of 7 per cent. in Anantapur, 3 per cent. in Hindupur and 2 per cent. in Tinnevelly and a fall of 17 per cent in Madura, 14 per cent. in Kumbakonam and Negapatam, 12 per cent. in Trichinopoly, 11 per cent. in Cuddalore, 8 per cent. in Conjeeveram, 5 per cent. in Virudhunagar, 3 per cent. in Guntur and 2 per cent. in Chittoor, the prices remaining stationary in the other markets.

Crop – Gingelly—1938–39—Intermediate report. Sowings of late gingelly are in progress in most districts and the germination is fairly good.

The wholesale price of gingelly per imperial maund of 82⅔ lbs. (equivalent to 3,200 tolas) as reported from important markets on 6th February 1939 was Rs. 6—11—0 in Tinnevelly, Rs. 6—9—0 in Trichinopoly, Rs. 6—3—0 in Cuddalore, Rs. 6—1—0 in Salem, Rs. 5—15—0 in Rajahmundry, Rs 5—12—0 in Cocanada, Rs. 5—9—0 in Ellore, Rs. 5—2—0 in Vizianagaram and Tuticorin and Rs. 5 in Vizagapatam. When compared with the prices published in the last report, i. e., those which prevailed on 9th January 1939, these prices reveal a rise of approximately 4 per cent. in Rajahmundry and Cuddalore and 1 per cent. in Tinnevelly and a fall of approximately 5 per cent. in Vizagapatam, 4 per cent. in Cocanada and 3 per cent. in Trichinopoly, the prices remaining stationary in Vizianagaram, Ellore, Salem and Tuticorin.

Sugarcane—1938—Third or final report.—The average of the areas under sugarcane in the Madras Province during the five years ending 1936-37 has represented 3 2 per cent of the total area under sugarcane in India.

The area planted with sugarcane up to 25th December 1938 is estimated at 96,930 acres. When compared with the corresponding estimate of 97,510 acres for the previous year and the actual area of 97,965 acres according to the Season and Crop Report, the present estimate reveals a decrease of 0 6 per cent and 1·1 per cent respectively. The estimate of the previous year fell short of the actual area by only 455 acres or 0·5 per cent.

The present estimate of area exceeds the second forecast by 6,130 acres. The excess occurs mainly in Vizagapatam, Bellary, Salem, Coimbatore and Trichinopoly.

The decrease in area in comparison with the actual area of 1937 as per Season and Crop Report occurs in all districts outside South Arcot, Salem, Coimbatore Trichinopoly, Tanjore, Madura, Ramnad and the West Coast.

The crop suffered to some extent on account of the cyclone in November in East Godavari, West Godavari, and Kistna. In parts of South Kanara the crop was affected by floods. The growth of the crop was also affected by the failure of the North-East monsoon rains in some of the other important districts.

The harvest has just commenced and yields below normal are expected in all districts outside Guntur, Bellary, Chittoor, Salem, the South Arcot and Malabar where the yield is expected to be normal. The seasonal factor for the province is calculated at 94 per cent of the average as against 99 per cent in the previous year according to the Season and Crop Report. On this basis, the yield is estimated at 261,130 tons of jaggery as against 266 630 tons estimated in January 1938 a decrease of 2 1 per cent and as against 278,820 tons, estimated in the Season and Crop Report of the previous year, the decrease in this case amounting to 6 3 per cent.

The wholesale price of jaggery per imperial maund of 82⅔ lb. (equivalent to 3,200 tolas) as reported from important markets on 23rd January 1939 was

Rs 9 14—0 in Adoni, Rs. 7—9—0 in Chittoor. Rs. 7—4—0 in Salem, Rs 7—1—0 in Vellore, Rs. 6—15—0 in Erode Rs 6—10—0 in Mangalore, Rs. 6—7—0 in Cuddalore Rs. 5—14—0 in Trichinopoly, Rs 5—12—0 in Cocanada and Rajahmundry Rs. 5—8—0 in Vizagapatam, Rs 4—15—0 in Bellary and Rs. 4—13—0 in Vizianagaram. When compared with the prices published in the last report, i. e., those which prevailed on 5th December 1938, these prices reveal a rise of about 29 per cent in Erode, 22 per cent in Chittoor, 20 per cent in Mangalore and 10 per cent in Vellore and a fall of about 22 per cent in Rajahmundry, 20 per cent in Vizagapatam, 12 per cent in Cocanada and 9 per cent in Trichinopoly, the prices remaining stationary in Vizianagaram, Adoni, Bellary, Cuddalore and Salem. *(Director of Industries, Madras)*

Cotton Raw. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st to 10th February 1939 amounted to 4,785 bales of 400 lb. lint as against an estimate of 294 200 bales of the total crop of 1938-39. The receipts in the corresponding period of the previous year were 6,379 bales. 8,342 bales mainly of pressed cotton were received at spinning mills and 2,987 bales were exported by sea while 6 203 bales were imported by sea mainly from Karachi and Bombay. *(Director of Agriculture, Madras).*

College News and Notes

Students' Corner. *Cricket.* On 1—2—39 a friendly match was played between C. Ramaswami's Eleven and K. M. Thomas's Eleven. C. Ramaswami Eleven—204 for 7; C. Ramaswami 59, Kothandram 59, H. Shiva Rao 47, S. V. Srinivasan 4 for 60 and K. M. Thomas's Eleven. 144 for C. N. Babu 49; Kamath 35; S. V. Srinivasan 30. K. M. Shetty 30; Kothandaram 3 for 62. and Hegde 2 for 27.

The Agricultural College team visited Salem on 5—2—39 and played a friendly cricket match with the Salem Gymkhana and won by 125 runs. Agricultural college 201 for 7 (C. M. Babu 80, C. Ramaswami 56, Caley 3 for 70 and Amir Pasha 3 for 7) Salem Gymkhana 76 (Nageshwara Rao 10 Sampath 14, Govindaswami 15, Dixon 13 not out; S. V. Srinivasan 1 for 26 and Kothandaram 5 for 28).

The return Match with the Salem Gymkhana was played on our grounds on 12—2—39. Agricultural College 203 for 7 (K. K. R. Menon 71, C. N. Balu 50, Kothandaram 18, K. Dinker Rao 16 not out Amir; 2 for 48, Venkataram 2 for 47 and Govindaswami 2 for 28), Salem Gymkhana 56 (Amir Pasha 12, Raghevandran 11. Govindaswami 11 not out; M. Mukundan 5 for 7, Kothandaram 2 for 7, Dinker Rao 3 for 21) and following on 54 for 4 (Govindaswami 12, Ranganada Rao 15, Nagheswara Rao 15 not out).

The following intertutorial cricket matches were played during this month.

1. A. C. Pillai's wards won against P. V. Ramiah's wards, A. C. Pillai's 51 (M. R. Nagaraj Rao 30, K. S. Ramaswami 8 for 20, V. Jayaraman 2 for 20) and 53, (N. Govindaraj 24, K. S. Ramaswami 5 for 14, V. Jayaraman, 5 for 38); P. V. Ramiah's wards 40. (K. N. Govindaraj 8 for 12) and 30 (P. S. Srinivasan 13, M. R Nagaraj 8 for 12).

C. Narasimha Ayyangar's wards won against K. M. Thomas' wards. C. N. Ayyangar's 126 (K. M. Shetty 77, Koulatalaya 23, Dinker Rao 4 for 45, K. M. Somanna 4 for 13) K. M. Thomas's 93; (Mr. K. M. Thomas 32, K. M. Somanna 27, Dinker Rao 13, K. M. Shetty 6 for 31).

A. C Pillai's (Mr. Kantiraj's) won against C. R. Srinivasan's M. Kantiraj's—92 (M. R. Nagaraja Rao 45, T. R. Viswanath 23, Santhanam 6 for 48) C. R. Srinivasan —64 (G. Madhuram 24, Punja 11, M. K. Adeni 15).

In the finals between M. Kantiraj's and C. N. Ayyangar's the latter won the cup. C. N. Ayyangar s Wards—125 (K. M. Shetty 76, Menon 10, Kothandaram 7 for 31) M. Kantiraj's - 88 (M. R. Nagaraj Rao 47, Kothandaram 12, K. M. Shetty 6 for 25, Menon 4 for 50).

Students' Club. Sri A. B. Shetty, Parliamentary Secretary to the Hon'ble Minister for Public Health, addressed a meeting of the Students' Club on the 9th of February in the Freeman Hall. Sri. Ramalingam Chettiar, M. L. C. was in the chair. Mr. Shetty speaking on Nutrition and Agriculture dwelt on the poverty of the Indian people and showed how it led to under nutrition. He was of opinion that even rich people did not know the correct principles of diet and consequently they suffered from malnutrition. This serious problem of under-nutrition should be combated, he said, by a systematic effort made to raise the standard of living of the Indian people and also by teaching them to standardise their diet in conformity with bodily requirements.

On 17 -2—39 Sri. M. Bapineedu delivered a lecture at 4 P. M. under the Presidency of Mr. R. C. Broadfoot. He advised to students to take more interest in rural reconstruction and thus be of more service to the motherland.

Officers' Club, At a General body meeting of the Club on 27—1-·39 the following were elected office bearers for the year 1939.

President	Sri N. L. Dutt.
Vice President	„ T. S. Ramasubramaniam.
Secretary	„ M. A. Sankara Ayyar.
Treasurer	„ S. Ramaswami Raju.
Committee Members	Mr. K. M. Thomas, Sri K. Subba Rao and C. V. Nagaraja Rao.

The Fieldmen's Association At a general body meeting held on 3—2—39, the following office-bearers were elected for 1939.

President	Sri S. Gnanaprakasam Pillai.
Secretary	„ C. S. Narayanaswami Ayyar.
Asst. Secretary & Treasurer	„ C. K. Kuppumuthu Pillai.
Committee members.	„ D. Devasirvatham Pillai.
	„ C. R. Venkataraman.
	„ V. Narayana Ayyar.
	„ S. Kalyanasubramaniam.

Visitors. Mr. D. B. Gazdar, Plant Pathologist to the Government of Siam was at Coimbatore from 20th to 23rd January.

Sri. A. B. Shetty, Parliamentary Secretary to the Hon'ble Minister for Public Health visited the College and Research Institute on 9—2—39.

Sri. Bapineedu, Parliamentary Secretary to the Minister for Public Information visited the Research Institute and the College on 17—2—39.

The Agricultural College Bhajana Association. With the object of making the Bhajana celebrations a permanent feature, the above Association was formed by the Bhajana devotees of the Estate. The " Radhakalyanam " was celebrated as usual this year on 1—2—39 with great eclat.

Weather Review—JANUARY 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st	Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·0	0·2	0·0	South	Negapatam	1·4	-0·3	1·4
	Calingapatam	0·2	0·1	0·2		Aduthurai*	2·4	-0·3	2·1
	Vizagapatam	0·0	0·5	0·0		Madura	0·9	+0·3	0·9
	Anakapalli*	0·2	-0·1	0·2		Pamban	1·8	-0·3	1·8
	Samalkota*					Koilpatti*	1·9	+0·5	1·9
	Maruteru*	0·2	+0·1	0·2		Palamkottah	2·1	+0·6	2·1
	Cocanada	0·2	0·0	0·2					
	Masulipatam	0·0	-0·2	0·0					
	Guntur*	0·0	0·0	0·0	West Coast	Trivandrum	0·5	-0·2	0·5
						Cochin	0·0	-0·7	0·0
Ceded Dists.	Kurnool	0·0	-0·2	0·0		Calicut	0·1	-0·3	0·1
	Nandyal*	0·0	0·0	0·0		Pattambi*	0·0	-0·2	0·0
	Hagari*	0·0	0·0	0·0		Taliparamba*			
	Siruguppa*	0·0	-0·1	0·0		Kasargode*	0·0	-0·2	0·0
	Bellary	0·0	-0·1	0·0		Nileshwar*	0·0	-0·2	0·0
	Anantapur	0·0	-0·4	0·0		Mangalore	0·0	-0·1	0·0
	Rentachintala	0·0	...	0·0					
	Cuddapah	0·1	-0·3	0·1					
	Anantharajupet*	2·94	+2·79	2·94	Mysore and Coorg	Chitaldrug	0·0	-0·3	0·0
						Bangalore	0·6	+0·5	0·6
Carnatic	Nellore	1·0	-0·7	1·0		Mysore	0·3	+0·1	0·3
	Madras	0·7	-0·7	0·7		Mercara	0·9	+0·8	0·9
	Palur*	0·0	0·0	0·0					
	Tindivanam*	0·7	-0·7	0·7	Hills	Kodaikanal	3·7	+0·8	3·7
	Cuddalore	3·5	+1·4	3·5		Coonoor			
Central	Vellore	2·0	+0·5	2·0		Ootacamund*	1·3	-2·9	1·3
	Salem	0·6	+0·3	0·6		Nanjanad*	0·6	-0·6	0·6
	Coimbatore	2·3	+1·7	2·3					
	Coimbatore A. C. & R. I.*	2·1	+1·4	2·1					
	Trichinopoly	1·9	+1·2	1·9					

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette.

Conditions were unsettled in the south of the bay about the 7th and a cyclonic storm formed there, but weakened, and became unimportant by the 11th. This caused local rains till the 15th in Southeast Madras, North Madras Coast and Malabar. Local rains were also recorded in Madras and extreme south of Peninsula on the 19th, 20th, 24th and 25th. Except for the above rainfall dry weather prevailed in the Peninsula.

Skies were lightly to moderately clouded in the Madras Presidency. During most of the days humidity was in defect.

Maximum and minimum temperatures were generally above normal.

Weather Report for Research Institute Observatory.

Report No. 1/39.

Absolute Maximum in shade.	...	88°F.
Absolute Minimum in shade.	...	56·9°F.

Mean Maximum in shade.	...	84·3 F.
Departure from normal	...	1·6°F.
Mean minimum in shade.	...	62·9°F.
Departure from normal.	...	- 1·3°F.
Total rainfall.	...	2·14″.
Departure from normal	...	+ 1·44″.
Heaviest rainfall in 24 hours.	...	1·89″ on 12th.
Total number of rainy days.	...	2
Mean daily wind velocity.	...	2·8 m. p. h.
Mean Humidity.	...	77 %
Departure from normal.		0·8 %

The weather was fine throughout the month The skies were lightly to moderately clouded and a fall of 1·89″ occurred on the 12th. The day and night temperatures were below normal. P. V. R. & T. C.

Departmental Notifications.

Gazette Notification.

Name of officers.	From	To
Mr. C. M. John,	Temporary Superintendet, A. R S., Tindivanam	Offg. Oil Seeds Specialist, Coimbatore.
Sri C. R. Seshadri,	Asst., Oil Seeds Section, Tindivanam,	Temporary Supdt., A. R. S., Tindivanam,

Transfers.

Name of officers.	From	To
Sri P. S. Narayanaswami Ayyar,	Cotton Section, Coimbatore.	Asst., Entomology Section, Coimbatore.
„ P. N. Muthuswami,	Offg. F. M., A. R. S., Siruguppa,	Offg. A. D., Ginjee.
Janab Khadir Razak Sahib,	Offg. A. D., Proddatur,	Offg. F. M., A. R. S., Siruguppa.

Leave.

Name of officers.	Period of leave.
Sri. P. S. Krishnamurthy, Entomology Asst., Bellary.	L. a. p. for 20 days from 20-2-39.
„ S. G. Aiyadurai, Asst. in Oil Seeds, Coimbatore.	L a. p. for 31 days from 6-3-39.
„ M. Subramania Chetty, A. R. S., Guntur.	L. a. p. on m. c. for 30 days from 6-2-39.
„ G. Sitarama Sastri, A. D., Repalli.	L. a. p. for 30 days from 27-2-39.
„ S. Venkatarama Ayyar, A. D., Mannargudi.	L. a. p. for 21 days from 20-1-39.
„ S. Rama Rao, A. D. Hospet.	L. a. p. for 1 month from 12-1-39.
„ S. Ramachandran, Asst. in Entomology, Coimbatore.	L. a. p. for 4 months from 30-1-39.

Sri. N. H. V. Krishnamurthy, F. M., A. R. S., Anakapalle.	Earned leave for 15 days from 10-1-39.
„ S. M. Kalyanaraman, Asst. Cotton Section, Coimbatore.	L. a. p. for 6 weeks from 6-2-39.
„ T. V. Krishnaswami Rao, A. D , Sompeta	Extension of l. a. p. for 26 days from 3-2-39.
„ R. G. Mal, A. D. (on leave).	Extension of leave on half-average pay for 4 months from 9-2-39.
„ P. V. Hanumantha Rao, A. D., Koilpatti.	L. a. p. for 3 months from the date of relief.
„ K. E. Viswam Aiyar, A. D., Tiruvannamalai.	L. a. p. on m. c. for 1 month from 28-1-39.
„ A. M. Muthayya Nattar, A. D. (on leave).	Extension of l. a. p. on m. c. for 45 days from 8-1-39.
„ P. Gopalakrishnan, F. M., A. R. S., Nanjanad.	L. a. p. for 1 month from 8-1-39.
„ C. V. Sundaram, Asst. in Entomology, Coimbatore.	L. a. p. for 3 weeks from 8-2-39.
„ P. Ramanadha Rao, A. D., Atmakur.	L. a. p. on m. c. for 28 days from 31-1-39.
„ S. Venkataswami, A. D., Mannargudi.	L. a. p. for 3 weeks from 20-1-39.
„ K. V. Shenai, A. D., Coondapur.	L. a. p. for 1 month from 11-1-39.
„ F. L. Daniel, Offg. Asst. in Chemistry, Coimbatore.	Extension of earned leave on average pay for 30 days from 6-2-39.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during January 1939.

A. Books.

1. *Report on Agricultural Research in Great Britain*. Eng. P. E. P. Report. (1938). 2. *Silage and Crop Preservation.* Watson, S. J. (1938). 3. *Planning and Planting your own Place.* Van De Boe, L. (1938). 4. *Our Shade Trees.* Felt, E. P. (1938). 5. *Principles of Tree and Small Fruit Culture.* Kelley, V. W. (1937). 6. *Weeds of Grass Land.* Long, H. S. (1938). 7. *Land Utilization in China.* Buck, J. L. (1937). 8. *Trends of Agriculture and Population in Ganges Valley.* Birendranath Ganguli. (1938). 9. *Part time Farming in the South East (U. S. A.) Works—Progress Administration—Social Research Monograph No 9.* (1937). 10. *Introduction to the Botany of Field Crops 2 Vols.* Hector, A. M. (1936). 11. *The structure of Economic Plants.* Hayward, H. E. (1938). 12. *Plant Physiology 2nd Revised Edn.* Maximov, N. A. (1938).

B. Administration Reports.

1. Administration Report of the Agricultural Department of Madras Presidency for 1937-38. 2. Agricultural Stations report of the Department of Agriculture, Burma for the year ending 31st March 1938. 3. Indian Central Cotton

Committee, Bombay, Proceedings of the meeting held on 12th and 13th July 1938. 4. Annual Report of the Field Experiments on Sugarcane in Trinidad, 1938. 5. Annual Bulletin of Divisional Reports of Fiji, 1937. 6. Cyprus Annual Report of the Department of Agriculture for 1937. 7. British Honduras Annual Report of the Department of Agriculture for 1937. 8. St. Kitts-Nevis, Report of the Agricultural Department for 1937. 9. St. Vincent, Report of the Agricultural Department for 1937. 10. Jamaica, Annual Report of the Department of Agriculture for 1937. 11. Seychelles Annual Report of the Department of Agriculture for 1937. 12. Report of the Minister of Agriculture for the Dominion of Canada, 1937. 13. Progress Report of Apiarist, Bee Division for years 1934 to 1936. 14. Texas Annual Report for 1936. 15. Annual Report of the International Crop Improvement Association 1937.

The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

Vol. XXVII.] MARCH 1939 [No. 3.

EDITORIAL

Plantation Crops. An average Indian peasant's interest in agriculture centres round the production of forage and food crops. Of late there is an incentive to grow industrial crops popularly known as money crops. But he is little acquainted with plantation crops nor has he the means to take them up. Some of them are of comparatively recent introduction in India; others are indigenous to India. They comprise crops like tea, coffee, rubber, cardamoms, and cinchona. Crops like tea, coffee, cardamoms and cinchona require a subtropical climate obtainable at higher elevations along the hill slopes which command good rain-fall and sunshine. Organised cultivation of these crops entails high capital expenditure in the initial stages. Probably the rigour of climate, lack of capital and specialized technique of cultivation must have stood in the way of the Indian taking to this type of cultivation. The production of these crops is mostly sponsored by Europeans, who are popularly known as the planters: they have been the pioneers in the line and have pushed up the cultivation in Nilgris, Mysore Malnad, Annamalais and the hill districts of Travancore and Cochin. Ever since Bababudan planted a few coffee seeds in Mysore in 1670 the area under the plantation crops had gone up steadily giving to-day a total of 79,000 acres of tea, 95,000 acres of coffee, 18,000 of rubber and 5000 of Cardamoms in the Madras Presidency, exclusive of those of the South Indian States.

These crops were remunerative till recent years; but now, due to over production in the world and other causes, there has been a general slump in prices. Restriction of production had to be imposed in the case of tea and rubber to keep the industry going. Of the planation crops, tea and cardamom alone are in a more fortunate position than the rest. In the case of cardamoms the home market continues to absorb the product, as the Indian is a lover of spices to the core and needs it for his domestic, social and religious purposes. For those who might feel interested in these types of crops, the Editorial Board has been able to secure contributions from competent sources, the first of which is published in this issue under the title "Tea Cultivation in South India" by Mr E. A. Stone of Gajamudi estate.

Some Useful Orchard Equipments Devised at the Fruit Research Station, Kodur.

By K. C. NAIK, B. Ag (Bom.) M. Sc., (Bristol)
Superintendent, Fruit Research Station, Kodur.

Introduction. Commercial fruit-growing is relatively a recent enterprise in this presidency as in the rest of India. Although fruits have been grown in this country from ancient times, the production has mainly been restricted in the past to small plots for making a variety of fruits available in all seasons for home consumption and in some cases to the urban centres. Large-scale or specialised orcharding is gradually coming to stay with the advancement of education and the rapid increase in the demand for fresh fruits particularly among the urban population. The increasing realisation of the valuable dietetic properties of fruits and the huge profits made by some of the pioneers in the field of fruit growing have stimulated the expansion of fruit industry, and as a result, the commercial culture of fruits is receiving considerable attention throughout this province.

Low production cost is the *sine quo non* of success in commercial fruit-growing. Labour charge is admittedly a heavy item in every orchard and nursery, and any implements devised to reduce the cost under this item or to increase efficiency are to be welcomed. The various equipments described in these pages have been devised with these above-mentioned objects in view.

I. GRAFTING POT STAND

Mango forms the leading fruit crop in this province, occupying roughly 250,000 acres. The major part of the activities of our nurserymen is at present devoted to the raising of mango grafts for sale to the public. The process of grafting known as inarching, is the only commercial method now employed in the propagation of mangoes. This process involves the raising of mango seedlings called, rootstocks and grafting these to shoots named scions from good bearing trees of the desired variety. As commonly practised, the inarching operation necessitates the erection of special wooden platforms or stands every season for placing the potted rootstock seedlings close to the scion shoots. In such cases, however, the scion shoots in the inner parts of the tree or in positions farther away from the platform or stand and do not become available for inarching. In some nurseries the pots are also tied to a strong branch of the scion parent tree close to the shoot intended for inarching. The practicability of this method depends on the nearness of the scion shoot to a strong limb. Considering the fact that several hundreds of mango varieties are grown in this province and the nurserymen are required to meet the orders for grafts of a very large number of varieties, it has become necessary to stock the nurserymens' gardens with a number of parent trees of all the numerous

reputed varieties. Any devise to increase the available number of scion shoots from a few parent trees will, therefore, lead to considerable economic benefit to the nurserymen.

In some nurseries near Chittoor and Salem, the practice of training the scion trees to a small manageable size and producing a large number of scion shoots close to the ground level is also widely prevalent. Apart from the trouble and expense involved in the training of the trees, this system leads to a loss of crop, which could have been obtained from the trees if they had been allowed to grow to their normal size. Furthermore, even under this system, a large number of shoots on the upper regions of the crown becomes unavailable for inarching unless special stands are erected for the purpose of bringing the potted rootstock seedlings close to such scion shoots. Another important reason which can be advanced against this system is that, the purchaser of the grafts has no chance to verify the variety, productivity, fruit quality etc. of the scion parent, because of the special training methods practised and the consequent non productive nature of the trees.

With a view to raise a much larger number of grafts from the scion parents than is possible by the prevalent methods and to reduce the recurring expenditure on the erection of platforms and stands or on tying the pots to the branches, a metal pot stand as shown in figure 1 was devised at the Fruit Research Station, Kodur. The stand consists of a metal ring which serves as a receptacle A to the pot, and this is connected by a horizontal adjustable rod B to another rod C having a clamp D at one extremity for securing the stand to the limb or to a wooden or bamboo post. A small rod connects B and C and aids in the adjustment of the stand according to the position of the scion shoot relative to the main limb or post.

The stand has been used for inarching plants *in situ* and for raising grafts with scions from full grown trees and has proved its efficacy in either case. It has also established its usefulness for 'top-working' trees to better varieties and for 'double-working'.

The cost of the stand, is however, a limiting factor in its becoming popular. Messrs. Shoranur Metal Works, who are manufacturing the stand, quote Rs. 22—8—0 for 12 or Rs. 2—0—0 each, ex-factory. As compared to this, the cost of erection of a platform or tying the pots to scion limbs works out roughly to a minimum of one anna and six pies respectively per graft per season. In view of the fact that these metal stands can be used over and over again for a number of years with no recurring cost excepting on bamboo posts when used for grafting low-hanging scion shoots, the extensive use of these stands in preferance to the prevalent methods deserves consideration from the nurserymen. Where the scion parents are limited in number, these metal stands are bound to prove very helpful by rendering it possible to raise a much larger number of grafts than it would be possible otherwise.

II. NURSERY TRANSPLANTER

In a commercial nursery, the cost of labour on transplantation of seedlings and vegetatively propagated plants to nursery beds or pots forms a very important item. In citrus, the transplantation of seedlings is usually done once from seed to nursery beds and again to fresh nursery beds 4 to 6 months after budding for hardening the budlings. In mangoes, the seedlings have to be lifted from the beds and transferred to pots when inarching is to be practised. In the case of plants raised by cuttings, the rooted plants are usually lifted from the beds or pots after a period, depending upon the variety, and transferred to fresh pots or nursery beds. The transplanting operation has also to be carried out in the case of a large number of trees used for wind-breaks and in the case of some plants used for hedges.

The digging of pits in nursery beds and lifting of plants are, therefore, the two essential operations that are associated with transplantation in fruit nursery practice. The implements commonly used for carrying out these two operations are spades, *mamuties* or small hand tools consisting of a long handle with a flat or slightly curved blade of the type known as *dokudupara*. Sometimes in heavy soils, an ordinary or a pitting crowbar is also employed for digging pits ; but for lifting the plants, these implements and spades are of no value. Retaining a ball of earth intact around the roots of all our tropical fruits at the time of transplantation is essential ; and this is usually achieved at present by the use of *Dokudupara* or a hand tool of similar design.

The nursery transplanter divised at the Fruit Research Station, Kodur, answers both the purposes of lifting of seedlings and young plants and digging of pits in nursery beds under certain soil conditions. It consists of a long circular blade of the shape and size of a 6" to 12" pot rivetted to a T shaped handle. The blade is provided with a longitudinal slit as is shown in figure II. It differs from the pitting crowbar devised by the Research Engineer, Coimbatore in having a tumbler-shaped blade and in being lighter in weight.

Six different types of transplanters with varying sized slits and blades have been devised and used to carry out extensive tests at the Fruit Reseach Station, Kodur during the past two years. These trials have revealed that the two transplanters shown in figure II are the most suitable for work in soils of light to medium texture. In heavy soils these transplanters cannot be worked satisfactorily. It has also to be pointed out that these implements cannot be employed in soils which are not previously worked to a reasonably fine tilth. Soils in seed and nursery beds have to be necessarily kept in good tilth, and it is only in such soils these tools have proved their efficacy.

For working this simple implement, no special instructions are necessary. For digging the pits, it is only necessary to push the tool down through the soil by using the necessary force through the hands and by

resting one foot of the operator on the upper edge of the circular blade. A few occasional twists of the hand in the manner of operating a steering wheel of a car is helpful in expediting the progress of the blade down into the soil. After the blade has reached the required depth, a slight twist is finally given to the handle and the tool is drawn out of the soil. While lifting the plants, the same process is employed, excepting that the plant intended to be lifted has to be passed through the slit at the outset and has to be kept in the centre of the circular patch of soil formed within the blade. After the transplanter is forced down and drawn out, the plant with the ball of earth around its root intact is pushed away gently from inside the blade. It is then ready for planting in the new pits dug out with the same tool in nursery beds or for potting.

The cost of medium sized transplanters (Vide A Fig. II) is quoted at Rs. 1—8—0 each and Rs. 32—0—0 for 25, ex-factory by Messrs. Shoranur Metal Works Ltd. The average cost of digging 100 pits in nursery beds in medium loam soil by the medium-sized transplanter works out to Rs. 0—1—4 as against Re. 0—3—2 by the *dokudupara,* while the cost of lifting citrus seedlings under similar conditions comes to Re. 0—1—7 and 0—3—8 respectively. An adult has been able to lift 250 plants or dig 300 pits by the above transplanter during 8 working hours, as compared to 110 plants and 120 pits respectively by *dokudupara*. It is thus clear that the transplanter has proved its usefulness and will, therefore, be a welcome addition to the equipments of our nurserymen having similar soil conditions as those referred to above.

III. PINEAPPLE "EYE" EXTRACTOR

The method of extracting 'eyes' from pine apples as practised at present consists of either scooping out 'eyes' from peeled fruits by means of pen-knife or slicing out thin linear portions of the flesh and the 'eyes' in a series of spiral grooves around the fruit. Both the methods are laborious, and in unskilled hands lead to a considerable loss of juice and flesh.

With a view to ensure the minimum loss of juice and flesh, and to effect a saving in time and facilitate a more convenient method of extraction of 'eyes'—the pineapple 'eye'—extractor was devised at the Fruit Research Station, Kodur, with considerable degree of success.

The instrument is very simple in design and works on the principle of forceps. Actual tests with this instrument in comparison with the method of eye-extraction with the pen-knife has shown that the extractor removes 100 'eyes' from Kew, Mauritius, Simhachalam and Queen varieties in 7.5, 5.0' 9.4 and 5.6 minutes respectively, as against 14,0, 12.5, 21.1 and 5.5 minutes respectively by pen-knife. The quantity of edible matter and juice wasted by employing the extractor is also very much less than by the use of pen-knife, it being on the average 5.0 ozs. per fruit in Kew, 2.0 ozs. for Mauritius by the former, as against 12.0 ozs. and 3.0 ozs. respectively by the latter. A thinner peel is required to be removed for use of the extractor

than for that of a pen-knife. Because of the fact that the fruit has to be handled for a shorter time, the extractor prevents too much bruising of the fruit and wastage of the juice. On the whole, the extractor does the work much more neatly and efficiently than a pen-knife, and, therefore, has proved its value not only for preparing the fruits for the table but also for the purpose of home-canning.

The extractor described above and shown in Fig. III-A has been found to remove the 'eyes' to a uniform depth only in skilled hands. For others, a blade with an adjustment to regulate the depth of insertion may be useful in order to reduce the loss of pulp and juice to the minimum. Since the size including the depth of the 'eyes' vary to a certain extent between varieties and to a small extent between individual fruits of the same variety, the value of regulating the depth of insertion will be felt both by the regular and casual users of the instrument. The extractor shown in Fig. III B answers this purpose. The improvement devised in this instrument lies in attaching an adjustable wing to each of the blades. These wings can be drawn in or slided down with the help of a screw moving through a slit as is shown in the figure. After extensively testing four instruments of different designs, the two described in these pages have been found to be the most suitable.

The cost of these extractors as quoted by Messrs. Shoranur Metal Works Ltd. is Rs. 2—8—0 for the first and Rs. 3—0—0 for the second instrument with the adjustable wing, ex-factory. Some reduction in cost is shown for orders for more than three instruments at a time. The instruments are made of stainless steel.

Summary. Three instruments, viz. grafting pot stand, nursery transplanter and pineapple 'eye' extractor have been recently devised and these have been found to be useful additions to the fruit-growers' equipments.

It is recognised that these instruments do not form, by any means, the last word in efficiency with regard to the various operations for which they are intended. The descriptions as given in these pages are not only intended to popularise these instruments but also to stimulate those interested in gardening to suggest or devise further improvements on the line, for which there may be some scope.

Acknowledgements. Sri. E K. Govindan Nambiar, Farm Manager, Taliparamba was responsible for suggesting the main improvements with regard to the nursery transplanter and for carrying out the trials in the early stages during his period of training at the Fruit Research Station, Kodur. All members of the staff of the Fruit Research Station, Kodur have also rendered help in designing and trial of all the instruments. The writer's thanks are due to all these officers of the Agricultural Department and also to the Imperial Council of Agricultural Research, under whose auspices this work was carried out.

Fig I Grafting Pot Stand
The method of using the stand of two different types on a bearing tree and of double-working *in situ* is also illustrated.

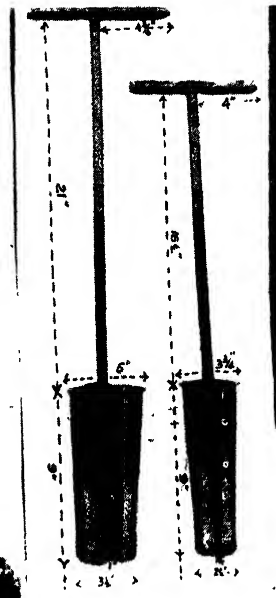


Fig. II.
A medium-sized and a mall 'Nursery Transplanter'.

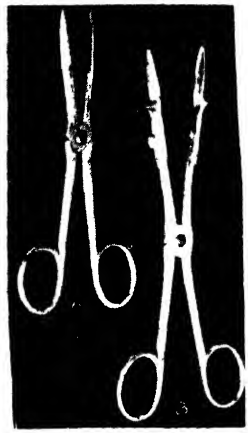
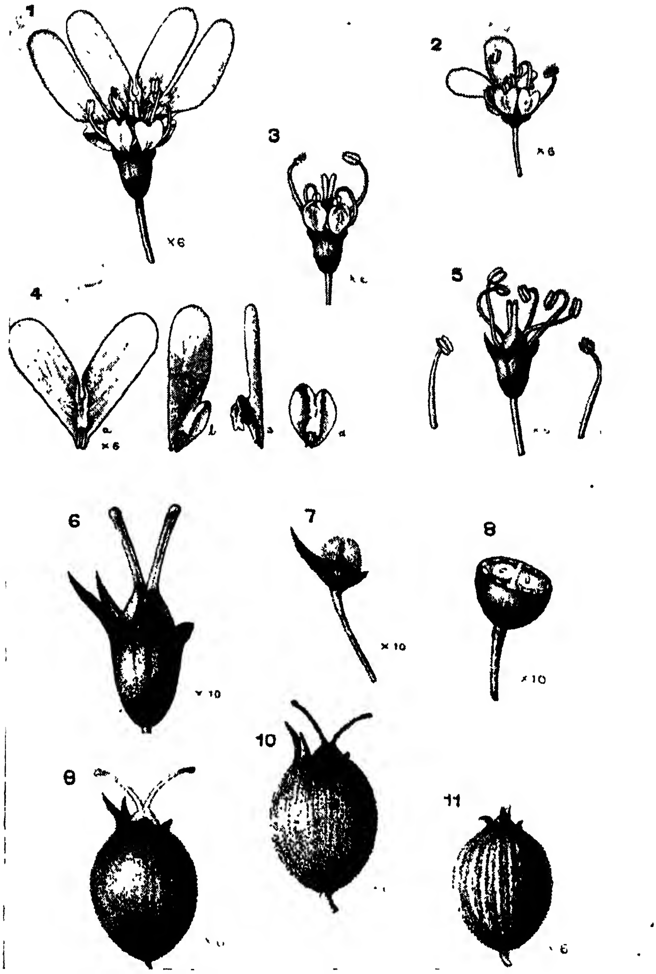


Fig III.
A.—a pineapple "eye" extractor for use in skilled hands.
B—an improved exractor which regulates depth of insertion.



FLORAL PARTS OF CORIANDER

Fig 1. Hermaphrodite flower.
Fig. 2. Male flower.
Fig. 3. Central hermaphrodite flower.
Fig. 4 (a) Two-winged petal with an incurved apical lobe.
(b) Single-winged petal with an incurved apical lobe.
(c) Non-winged petal with an incurved apical lobe.
(d) Petal showing the membranous ridge connecting the apical lobe
Fig. 5. Pistil and five stamens.
Left—Anther dorsifixed.
Right Anther dehisced.
Fig. 6. Pistil showing bifid nectary or stylopod.
Fig. 7. Bifid nectary in a male flower.
Fig. 8. Cross-section of an ovary.
Fig. 9. Young fruit.
Fig. 10. Ripe fruit with persistent styles and calyx.
Fig. 11. Dry fruit with persistent calyx.

Preliminary Studies in Coriander (*Coriandrum Sativum L.*)

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Introduction. Coriander is cultivated as a rainfed crop in almost all the black soil tracts of the Madras Presidency and it occupies an area of more than one hundred and twenty five thousand acres.

As this crop finds an important place in the system of cultivation of the black soil area in the Tinnevelly District, work was started in the Agricultural Research Station at Kovilpatti with the object of evolving a heavy yielding type of coriander. The method of its cultivation as practised in this district has been described by the author elsewhere (1937)

So far as the writer is aware, there is little information available on the floral mechanism of the coriander plant nor is there any record of any study on its anthesis. In the available literature, only a general description of the plant has been noted by various authors. This paper records an account of the observations on the anthesis of the plant.

Description of the Plant. As very many forms of coriander are grown in various parts of the world and since no description has been attempted to distinguish the South Indian type from others, a some-what detailed description is given here.

The form described, was derived from the local variety of coriander grown in the field and in pot cultures during the three years 1935—36 to 1937—38.

It is an annual herb with a characteristic aroma, varying in height from ½ to 2½ feet according to the type of soil, and climatic conditions. Its stem is round, striate, glabrous, usually light purple pigmented, though completely green types also occur occasionally. It is generally branched in the upper parts; first nodal branching does occur but it is rare.

Leaves, exstipulate, alterante, compound, petiolate with a sheath at the base, (petiole of the basal leaves 5 to 8 c. m. long and of the upper leaves 0·5 to 1 c. m. long;) basal leaves pinnate with broad leaflets, gradually turning bipinnate with narrow leaflets and finally becoming tripinnate towards the inflorescence with ultimate segments almost linear.

Inflorescence, a terminal compound umbel, stalked, the stalk being 6 to 40 c. m. long; very rarely subtended by a single bract 6 to 9 m. m. in length; an inflorescence is made up of 1 to 8 umbels, most frequently five. The umbel is subtended by an involucre of bracteole 4 to 7, green, linear unequal in size 1 to 5 m. m. long; it has a stalk 6 to 18 m. m. long. In each umbel both bisexual and unisexual flowers occur, the latter being in large numbers; an umbel comprises of 1 to 14 hermaphrodite flowers and 8 to 16 staminate flowers with an average of five of hermaphrodite and

eleven of staminate. The general type of umbel found in this variety can conveniently be divided into three regions, an outer-most whorl of four or five hermaphrodite flowers, a solitary hermaphrodite flower in the centre and thirdly a group of two or more whorls of male flowers between these two regions. In some umbels, two whorls of hermaphrodite flowers form the peripheral region. In a few cases male flowers occurred in the outer-most as well as in the innermost region, while in others, the whole umbel consisted of male flowers only, or undeveloped flowers with pistillode, or very minute incomplete flowers which shed soon.

The *Hermaphrodite flower,* this is pedicellate, the pedicel being 1½ to 3 m. m. long. In the central flowers it is always shorter having a length of about 0.5 to 1 m. m.

The *Calyx* is green, persistent gamosepalous, with five unequal tooth-like sepals 0·5 to1½ m. m. long; two teeth below the larger-winged petal are always longer than the rest.

The *Corolla* consists of five petals, free, white or lightly purple-tinged; in completely green types, petals are white; the petal has an incurved apical lobe which is slightly bifid at the tip (Fig. 4 a, b & c) and has a membranous midrib running from the base along the median line upto the point of curvature (Fig. 4 d). In the peripheral flowers three petals on the posterior side, possess usually wings in addition to the incurved apical lobe, the middle petal having generally two wings and the two adjoining ones one wing each (Figs. 1 & 4). These petal-wings are some-times unequal in size, radiating so as to give a characteristic and showy appearance to the umbel. The petals of the central flower do not develop as a rule any wing (Fig. 3).

Stamens are five in number, alternating with petals, filaments about 2 to 2½ m. m. long, anther light purple, two lobed, dorsifixed, dehiscing along longitudinal sutures (Fig. 5). Sterile anthers are generally yellow in colour but they do not ordinarily expand.

The *Ovary* is inferior and bilocular with a single ovule in each loculus (Fig. 8). On the top of the ovary is a green, bifid, fleshy, conical nectary termed as stylopod or stylopodium (J. S. Gamble 1919; Bentley and Trimen 1880; John Percival 1921) and from the top of this nectary arise two styles about 1 to 1½ m. m. long ending in a spherical stigma (Fig. 6). In odd instances, three styler arms were noted.

Staminate flowers, these are similar to hermaphrodite flowers in structure but smaller in size (Fig. 2); one or two petals in a few flowers only are drawn out into unequal wings. The flower is pedicellate, the pedicel being 1½ to 3½ m. m. long; ovary and styles are absent but the bifid nectary is present (Fig. 7).

Fruit. The ripe fruit is spherical in shape, smooth surfaced, light yellow with a light purple wash (Fig. 10). The dry fruit is a schizocarp, generally oval, four to six m. m. long and three to five m. m. wide. It has a brownish yellow colour and rough surface, marked with small longitudinal ribs, the

secondary ribs being slightly raised and more prominent than the primary ones; crowned by the persistent dry, brown, clayx-teeth (Fig. 11). The fruit does not readily dehisce but on slight pressure separates into two mericarps. The fruit emits an agreeable odour on rubbing.

Anthesis. In most of the flowers, the time of opening is not easily noticeable on account of the petals being incurved and non-spreading. Only in the case of flowers on the periphery which possess winged petals, the expansion of the wings is traceable. This is soon followed by the emergence of stamens. The time of flower-opening has, therefore, been reckoned from the emergence of the first stamen in a flower. The stamen emergence occurs in all flowers by the filaments elongating and pushing the anther out in between the two petals. The anthers emerge singly and very seldom two at a time. The time for all the five anthers in a flower to emerge, varies very widely depending upon the time of flower-opening or the emergence of first stamen. The data collected on this aspect are set out in Table I.

TABLE I. Interval for emergence of all stamens in a flower (from the first to the last stamen).

Emergence of first stamen (flower opening).	Emergence of last stamen.																					number of flowers observed.
	same day.												next day.									
	forenoon (a. m.)				noon.	afternoon (p. m.)							forenoon (a. m.)								noon.	
	8	9	10	11	12	1	2	3	4	5	6	7	4	5	6	7	8	9	10	11	12	
5 a. m.	...	1	...	.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
6 ,,	...	...	2	1	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
7 ,,	...	...	4	6	4	1	1	...	...	...	...	...	...	...	...	...	...	..	...	...	...	16
8 ,,	...	...	...	...	1	5	4	3	1	...	...	...	...	...	...	...	...	...	...	...	...	14
9 ,,	...	...	...	...	3	3	4	1	1	2	1	...	...	...	...	...	...	...	...	...	...	15
10 ,,	...	...	...	...	...	...	...	...	...	2	1	...	...	...	2	5	1	...	...	...	...	11
11 ,,	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1	1	2	...	...	...	...	5
12 noon	...	...	...	...	...	...	...	..	...	...	...	...	1	...	2	4	5	3	1	...	...	16
1 p. m.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	2	1	...	...	...	4
2 ,,	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	2	2	...	...	...	6
3 ,,	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	2	...	1	...	6
4 ,,	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	2	...	...	...	4
5 ,,	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	2	2	1	6
6 ,,	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1
																					Total	109

It will beseen from the above data that

(1) in the case of flowers that open up to 9 o' clock in the morning, the flower opening as indicated by the emergence of the last stamen is completed within the day itself.

(2) in the case of flowers that open later, the process is very much protracted, often extending upto noon on the following day

The above conditions are found alike both in hermaphodite and staminate flowers.

Anther Dehiscence. Anthers generally dehisce longitudinally within two to twenty four minutes after the expansion of the filaments. But in the case of stamens that emerge during the cool hours (4 A. M. to 7 A. M.) they open after one to two and a half hours. It takes one to six minutes for the completion of the dehiscence.

Developement of style and Stigma. At the time of emergence of the first anther in a flower, the two styler arms, each about half a millimeter in length remain close together with blunt tips, just above the level of the incurved petals. They gradually elongate upto a length of one to one and a half millimeter above the stylopod and protrude about half to three fourths of a millimeter above the petals. Further these two styles which were quite close to each other, slowly diverge and develop the stigmatic nob at the tip manifesting the protandrous nature of the flower.

Pollination. The pollination is effected chiefly by wind and to some extent by insects like bees and flies. It was interesting to observe that when single flowers were covered with tissue paper bags, no fruits set, while enclosing a number of flowers in a bag, gave upto 33% setting. It was also found that covering entire plants with bags of muslin, tended to reduce the yield. (Table II).

TABLE II. Yield of Coriander from bagged and non-bagged plants (1935—36).

	Mean yield per plant in grm.	Number of plants studied.
Bagged	5·65	41
Not bagged	13·25	41
Standard error of the difference in yield	0·81	

Progress of Flower Opening. For this purpose a group of inflorescences was chosen and the time of expansion of the first stamen was taken as the time of the opening of the flower. Counts of flowers opening every hour were taken separately for hermaphodite and male flowers in plants raised under rainfed and irrigated conditions during 1935-36 and 1936-37. The results are set out in Table III. From the Table III it is seen that

(1) the opening of the flower commences as early as 4 a. m. and continues upto 9 p. m. and sometimes extends even upto 10 p. m. both in the case of hermaphrodite and staminate flowers.

(2) The opening is at its maximum between 8 a. m. and 12 noon.

(3) In the case of plants raised on black soil under rainfed conditions, the hermaphodite flowers open at a faster rate than the staminate. This is further confirmed by a different set of observation made (Vide Table IV)

Rate of flower-opening in hermaphrodite and staminate flowers. In an inflorescence, the hermaphrodite flower buds commence to open earlier than the staminate ones. The rate of opening of the two kinds of flowers is shown in Table IV.

TABLE III. Percentage of flowers opened during hourly intervals.

Season	Conditons under which crop grown.	(Forenoon). 4	5	6	7	8	9	10	11	Noon 12	(Afternoon) 1	2	3	4	5	6	7	8	9	10	Number of flowers observed.
	(a) *Hermaphrodite flowers.*																				
1935—36	Black soil rainfed.	0·6	...	0·9	1·7	14·4	17·0	17·0	11·8	11·5	5·2	6·0	3·7	5·5	1·7	0·6	1·2	0·6	0·3	0·3	347
,,	Red soil irrigated	...	0·4	3·6	8·1	12·6	20·7	10·4	10·4	7·2	6·8	7·7	5·0	2·2	3·1	1·8	...	...	...	...	222
1936—37	Black soil rainfed.	0·3	0·6	4·3	5·5	16·1	16·8	11·0	11·6	7·3	8·8	5·8	2·7	3·7	3·7	0·9	0·9	...	...	...	328
,,	Pot culture irrigated.	...	...	4·3	11·2	6·9	16·0	11·2	10·8	10·3	9·5	3·9	6·0	3·0	3·9	2·2	0·4	..	0·4	...	232
	(b) *Staminate flowers.*																				
1935—36	Black soil rainfed.	...	...	...	2·2	8·0	11·2	18·9	9·6	12·9	9·1	8·5	5·8	5·8	3·8	2·9	1·1	...	...	0·2	449
,,	Red soil irrigated.	...	0·2	2·9	7·2	10·8	13·7	15·9	13·9	8·5	7·9	5·9	4·3	3·2	4·0	0·9	0·7	...	...	...	555
1936—37	Black soil rainfed.	0·1	0·3	...	1·6	2·9	21·8	15·6	13·0	8·4	14·4	6·0	5·3	5·6	2·6	1·0	0·7	0·6	0·1	...	694
,,	Pot culture irrigated.	0·6	0·6	3·9	3·0	10·0	11·5	17·7	12·4	8·6	8·5	7·9	5·3	2·8	3 6	1·7	0·7	0·6	0·6	...	531

TABLE IV. Comparison of the rate of flower-opening between hermaphrodite and staminate flowers in an inflorescence

Season.	Conditions under which crop is grown.	Kind of flowers.	Percentage of flowers opened per inflorescence per day. 1st day.	2nd day	3rd day.	4th day.	5th day.	6th day.	Actual number observed. flowers.	inflorescence.
1935—36	Black soil rainfed.	Hermaphrodite	14·7	38·1	30·3	16·9	...	...	224	6
		Staminate	...	2·3	22·2	50·2	25·3	...	391	8
1935—36	Red soil irrigated.	Hermaphrodite	21·5	47·9	26·1	4·6	...	...	242	8
		Staminate	...	6·4	39·6	38·8	14·6	0·7	565	
1936—37	Black soil rainfed.	Hermaphrodite	25·0	43·2	23·5	8·0	0·4	...	370	14
		Staminate	0·2	8·6	37·3	41·2	12·7	...	702	
1936—37	Pot culture irrigated.	Hermaphrodite	42·9	36·9	16·3	3·9	...	...	284	14
		Staminate	1·0	23·4	45·5	28·0	2·2	...	581	

Summary. Detailed observations were made on the floral parts of coriander grown at the Agricultural Research Station at Kovilpatti.

The inflorescence is a terminal compound umbel, made up of one to eight umbels, most frequently five. The flowers are arranged in whorls and both hermaphrodite and staminate flowers occur in the same umbel.

The flower-opening commences as early as 4 a. m. and continues upto 9. p. m. with an active period of blooming between 8 a. m. and 12 noon. In an inflorescence, hermaphrodite flowers in general open earlier than the male flowers which start opening about a day later and take a day longer to finish.

The flower exhibits a wide variation in the interval for stamen-emergence and anther-dehiscence. In the case of flowers that open upto 9 o' clock in the morning, the anthesis is complete within the day itself, the interval varying from three to nine hours. But in the case of those that open later, the interval extends upto twenty two hours.

The anthers dehisce only after sun-rise, the active period of dehiscence being from 8 a. m. to 12 noon.

Acknowledgment. My thanks are due to Sri. R. Chockalingam Pillai, L. Ag., Superintendent, Agricultural Research Station, Koilpatti, for facilities afforded and valuable guidance given in preparing this paper.

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The Use of the Digging Fork for the Eradication of Hariali (*Cynodan dactylon*).

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"Hariali grass (Tamil: *Arugam Pullu*) is the enemy of the black soil and the ryot who neglects it is the man to whom money should be advanced on the security of his fields, soon the mortgage will be fore closed upon and the land will change hands" says Mr. H. R. Pate, I. C. S. in the Madras District Gazetters, Tinnevelly. *Hariali* (*Cynodan dactylon*) is a common weed in cultivated lands and it is especially so in the black soils of Madura, Ramnad and Tinnevelly Districts. It is a weed very difficult to eradicate on account of its perennial mode of life and resistance to drought conditions. Its presence in cultivated fields is an unmistakable menace to the economic welfare of the ryots as it involves considerable amount of money, time and labour for eradicating the same. Hence the object of this short note is to show to the public the uses of a digging fork and how it has been successfully introduced by the Madras Agricultural Department in the black soil tract for eradicating this pernicious weed replacing the local implements hitherto used for the same purpose.

Before proceeding to describe the use of the digging fork for digging out *hariali*, a short description of the harm done by weeds to cultivated crops will not be out of place. In the matter of raising a good crop one of the foremost problems that confronts the ryots is the problem of controlling and eradicating weeds. In cultivated fields the loss due to an undesirable growth of weeds is enormous. The object of clean cultivation is to secure good produce and to avoid weeds. Weeds rob the young crop of its plant food, the energy of sun light and when allowed to grow up, they smother the crop to such an extent that the yield becomes poor and unsatisfactory. They may harbour insect pests, fungus diseases and bacteria which levy a heavy toll upon the crop. The market value of the land also goes down when infested with weeds as their presence involves considerable amount of money for their control and eradication.

The ryot, ignorant as he is of the history of the life of weeds, struggles against them with unsuitable implements. He is ignorant of the old adage that 'one year's seed is seven years' weed'. Annuals and biennials can be eradicated by simply cutting off the tops before seeding, but in the case of perennials we have to go still further and do the needful in time. The perennial weed, *hariali*, is so very hardy and resists drought so much that all attempts of the ryots with the local implements have not given the desired amount of success consistent with the amount of money, time and labour spent on it. The country plough cuts a V shaped furrow by the first ploughing leaving a wedge shaped unploughed portions of the soil and by the second and subsequent ploughings pyramid shaped unploughed

portions of the soil are left thus giving room for the subterranean branches and roots of the weed to persist. No doubt there is the iron plough which leaves no portion of the soil unturned but this weed has a net work of subterranean branches and roots spread to depths which the share point of an improved plough cannot tackle. The other local implements used for digging out *hariali* are the crow bar and a type of implement locally known as *vachath* after the model of a pick axe. In some tracts the *vachath* is used while in other tracts crow bars are more common.

Generally *hariali* digging is done in black soils in the dry season from March to April till about the close of August and is discontinued with the receipt of monsoon rains. It is done in fields where the cereals have been harvested and where the soil is cracked so that big clods of soil containing the subterranean branches and roots of *hariali* can be turned easily. While digging out *hariali* the ryots usually work in pairs one man handling the local crow bar or *vachath* and the other man working with a *mamooty.* Clods of soil containing the subterranean roots and branches are dragged out by the other man with the *mamooty* and exposed to the sun. Thus the roots and branches of *hariali* get dried up in the hot sun. Some clever ryots grow fodder cholam in a field infested with *hariali* and thus bring the roots and branches of the grass to the top layers of the soil, where they are easily tackled.

It will be interesting to know that as a result of departmental propaganda, digging forks have been successfully introduced for digging out *hariali.* There are now about 280 digging forks in 60 villages for digging out *hariali* and the time honoured local implements, crow-bar and *vachath,* are being replaced with digging forks. It has become so very popular in these villages that it is no more considered a foreign product and it is now a part and parcel of the equipment of a ryot in their villages. With the advantages of saving time, labour and capital, the digging forks relieve the ryots of a great amount of strain in fighting out a formidable foe, the *hariali* weed. Those who do not have digging forks of their own borrow them from others at a nominal hire of six pies to one anna per day People who own no lands and make a living as agricultural labourers have all replaced their local implements with digging forks, for they find that there is no demand for labour handling the local implements. In villages where the use of this implement is not yet known coolies from other villages who can successfully handle the digging forks are engaged for digging out *hariali.* Women coolies are very often engaged as partners to handle the mamooty. There are some women who can even successfully handle the digging fork. Some times we see a man and his wife working together, the former handling the digging fork and the latter the mamooty. The prongs of the digging fork are forced into the soil with the foot and big clods of soil with the *hariali* roots and branches are levered up. The clods of soil thus dug up are broken by two men with their mamooties and thrown aside. Thus the weed gets dried up in the hot sun.

Regarding the economics of the use of the digging fork in preference to the local implements, the former possesses several advantages over the latter. The digging fork with a D shaped handle or a T shaped handle is lighter and is easily lifted and pressed into the soil by foot using the weight of the worker. Thus it easily gets in and a greater volume of soil with the roots and branches of *hariali* is disturbed. When digging is done with the help of the local implements the ryots work in pairs one man handling the local digging implement and another assisting him with his *mamooty*. But in the case of the digging fork two men with their mamooties can assist a single man handling the digging fork This shows beyond doubt the rapidity and ease with which digging of *hariali* is done with digging forks. Three men with one digging fork and two mamooties turn out as much work as four men using two crow bars or *vachaths* and two mamooties. It is also found that to dig an acre infested with *hariali* to a depth of a foot and a half with digging forks, 90 men are required; but when the local implements are used 120 men are required. Formerly the man handling the digging fork used to get wages up to 8 annas a day; but now due to the economic depression and the large use of the implement by a good number of ryots he gets only 5 annas a day and his partner gets 4 annas a day. The man handling the local implement also gets 4 annas a day. Calculating at these rates it is seen that to dig out one acre with digging forks it costs Rs. 24—6—0 while it costs Rs. 30—0—0 an acre to dig with local implements. Besides the work turned out with the digging fork is more efficient as there is less chance of the weed remaining undisturbed.

Thus it is seen that the ryots have understood the great advantages of using digging forks over the local implements Due to the strenuous propaganda carried on by the department for distributing the implements far and wide, the demand for them is ever on the increase. Demonstrations, are conducted in the black soil villages during the *hariali* digging season and the procedure of digging out *hariali* and the advantages of using such implements are explained to the ryots with good results. The fork is also now an important item in the equipment of the depot of an Agricultural Demonstrator. A very large number of digging forks was distributed in recent years through departmental help. To such of those who are unable to make immediate payments *takkavi* loans have been granted by the department for purchasing digging forks. They are now most popularly used in two taluks of Aruppukottai in Ramnad District and Kovilpatti in Tinnevelly District. In the village of Puliampatti in Aruppukottai Taluq there are now about 100 digging forks and about 40 at Idaiseval in Koilpatti Taluq. In either of these villages, the local implements have practically been ousted and the ryots are now using only forks for digging out *hariali*.

Very recently it has come to the notice of the Department that the implements available now are not good and that the prongs have a tendency to bend. The quality and efficiency of the digging forks depend entirely upon the strength of the prongs and if one or two prongs get bent

the implement cannot be used further for digging out *hariali.* But the department has already taken up the question and the defects shall be rectified through the Research Engineer, Coimbatore and the ryots will have better digging forks as in the early years.

Besides its use for digging out *hariali,* the fork is a very valuable implement for other agricultural operations such as digging manure pits, digging out litter from trenches and manure from pits, intercultivating sugarcane and plantains and trimming bunds in cultivated fields. It has been successfully demonstrated for harvesting root crops like potatoes, sweet potato and yams. It is also a valuable horticultural implement and can be used to stir the soil in fruit gardens and to dig pits to plant seedlings and grafts. It is also popularly used to uproot unwanted and undesirable plants in fields and gardens. It is quite useful for non-agricultural operations such as excavations for foundations of buildings, digging wells, digging out silt in tank-beds, deepening tanks, and for a variety of other purposes.

I feel extremely thankful to Mr. A. Gopalan Nayar, Assistant Director of Agriculture, Tinnevelly who besides taking a keen interest in popularising this implement gave me all facilities to prepare this paper.

Tea Cultivation in South India.

By E. A. STONE

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Introduction. While accepting an invitation to write a few articles on tea cultivation for the *Madras Agricultural Journal,* the writer wishes to make it quite clear that these articles will be simple and elementary. There are many planters and scientists who will be able to write more detailed and learned articles should these be desired.

The tea plant (*Camellia Thea* Link) belongs to the family Ternstroemiaceae and is an evergreen requiring humid conditions for its growth. Provided the rainfall is spread out over the year it can manage on as little as 50 or 60 inches a year. In South India where the rainfall in the plains is well below that figure and is not spread over the year, tea flourishes only in the hills, especially in those hills where a heavy South west monsoon rainfall is usual. In the Shevaroys and parts of Mysore the rainfall is insufficient for tea, and coffee flourishes better; but in the Anamallais and High ranges which are further west and get the South West monsoon rains, tea does well.

Varieties and distribution. There are various varieties of tea grown in South India varying from the broad leaf Assam types to the China and China hybrid types. The broad leaf types are more tender and less able to stand extremes of cold and drought, and are therefore planted at altitudes

under 5,000 feet. In the High Ranges and Nilgiris where tea is grown up to 7,500 feet, the China varieties are used at the higher elevations. The leaves of these varieties are much smaller and tougher and possess a much thicker epidermis than the Assam types and are able to withstand frosty nights.

Hybrid varieties do not seem to do well and give poor crop. For this reason tea grown for seed must be situated several miles away from any other tea to avoid the risk of cross pollination. Excepting one or two small experimental areas tea is not cultivated for seed in South India. Seed is mostly bought from Assam, and is known by the name of the estate or district from which it comes – Rajghur, Jaipur, Betjan etc. For purposes of transport the seed is packed in powdered charcoal in half maund boxes. The number of seeds to a maund varies a good deal, but is somewhere about 15,000 or 16,000. The average tea seed is round, and a little over ½" in diameter being enclosed in a tough brown outer 'shell'.

NURSERY MAKING

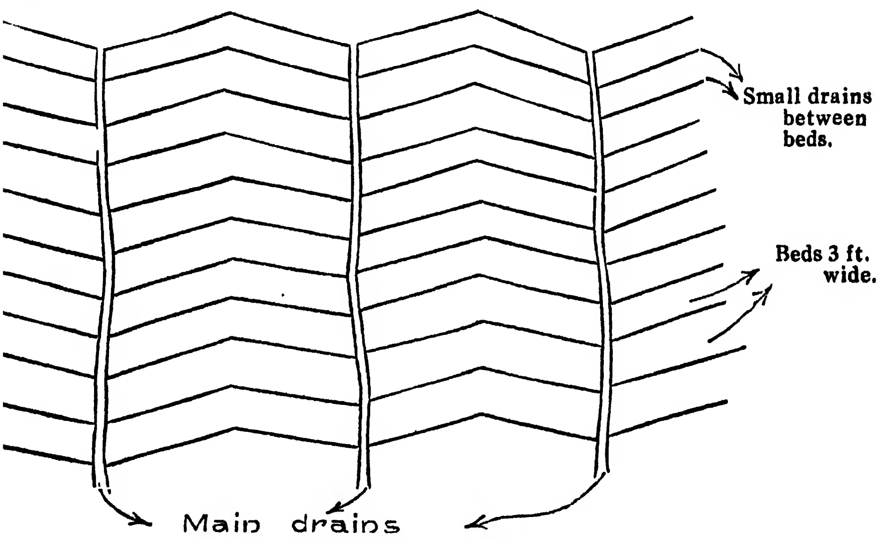
As soon as the seed arrives it is taken out of the boxes, washed and put out in germinating beds. These are simply beds of sand of a convenient width, and about 3 inches deep. The seeds are spread out one seed thick and then covered with another inch or so of sand. The beds are kept damp by daily watering and are well shaded by overhead *pandals*. Every 5 or 6 days the seeds are picked over and those which are starting to germinate are removed for planting out into nursery beds. The beginning of germination is heralded by the cracking of the brown outer cover, the crack being plainly visible when the covering sand has been brushed away. It is for this reason that sand is used, as it does not adhere to the seed as earth would, so masking the crack.

Sometimes the damp seed in the germinating bed is attacked by a slimy white fungal growth. It is therefore advisable to dip the ungerminated seed in a fungicide like a weak solution of copper sulphate before putting them back in the bed after each sorting.

Another pest which attacks the seed and young tea plant root is the 'eel worm' (*Heterodera marioni*). This parasite is invisible to the naked eye but plainly visible under the low power of the microscope. It is found in sour water-logged ground, and for this reason neither germinating beds nor nursery beds should be made in such situations, nor should they be over-watered, as this encourages the growth of eel-worm and fungal parasites. There are two ways of making the nurseries into which the germinated seed is planted.

(i) *Stump nurseries.* These are made in a convenient jungle area, facing east if possible, but any way sheltered from the west for two reasons: (a) to get the morning but not the evening sun and (b) to be sheltered from the heavy S. West monsoon squalls. The site must also be near an adequate water supply which will not dry up in the dry weather. The undergrowth and small trees are first cleared, and the ground dug about

two feet deep, every stone and root being removed. This is essential if twisted roots on the young tea plants are to be avoided and the easiest way to do it is to start at the bottom of the slope in the site and work upwards. (N. B. What little flat ground there is in the tea-growing hills is sure to get water logged in the wet weather and should not be chosen for nursery sites.) Next the beds are put in in such a way as to provide for the proper draining of the ground during heavy rains. Main drains are put down the hollows and the beds slope up from these on either side having a small drain about a foot wide and 4 or 5 inches deep between each bed. A bed should not be more than 3 or 3½ feet wide to allow labourers to walk round the beds to weed them and clear rubbish without treading on them. The final effect is similar to a number of herring bones placed side by side. (See diagram below).



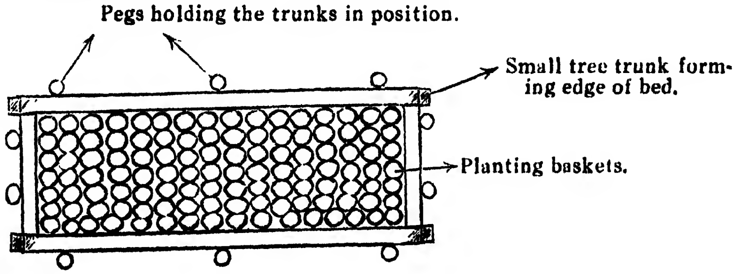
Herring-bone pattern of nursery beds.

The germinated seed is planted out in the beds 4 to 6 inches apart, the easiest method is to use a planting board with holes drilled through it at the required intervals. This is placed over the bed and a stick pushed through each hole to mark the correct spacing. The seed when planted should be only just covered with earth; if planted too deeply growth is retarded. It should also be planted the right way up, i- e., with the flat end downwards. One side of a tea seed is always slightly flat and it is on this side that the radicle invariably appears.

The nursery is shaded by the large trees which have been left when clearing, and a nicely dappled shade is ideal. In the rainy weather the drip from these tall trees damages the beds, and these should be continually earthed over with good jungle soil. It is also advisable to pave the main drains with large stone, as otherwise the passage of water scours them deeper and deeper until the ends of the adjoining beds fall in.

Seed is usually obtained in November, germinates and is planted out throughout December and part of January. Until the hotweather rains fall in April the nurseries have to be watered. At first it is necessary to water the beds every other day, but later when the plants are growing well it is advisable to cut down the watering to every third and fourth day. This allows the top soil to dry out periodically and encourages the formation of a good tap root.

(ii) *Basket nurseries.* In this type of nursery the ground is not dry. The beds are made up of baskets full of tightly packed sifted jungle soil, placed close together and kept in position by laying small tree trunks or branches along the edges of the beds (see diagram below).



Surface view of one bed.

Each basket is 9 "to a foot long and 5" or so wide so as to allow 3 or 4 months growth for the small tea plant. A *pandal* is erected over the beds for shading and watering and other items of attention are similar to those given to stump nurseries, except that basket nurseries tend to dry more quickly, and so need watering somewhat oftener. Basket nurseries cost more to make i. e. the cost per thousand plants when ready for planting out is higher than is the case with the stump or jungle nursery. The relative merits of the two kinds will be discussed in my next article which will deal with planting out in the clearing.

(To be continued).

SELECTED ARTICLE

Cardamoms

By W. MOLEGODE

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The cardamoms of commerce are the seeds of the herbaceous perennial *Elettaria cardamomum* of which three varieties are found in Ceylon. One of these is indigenous to Ceylon and grows wild in the wet forests in the higher elevations, chiefly in the Ratnapura and Luuugala districts. The cultivated varieties, Malabar and Mysore, appear to have been introduced from India. These two varieties are easily distinguishable by the characteristics noted below.

Malabar—leaves silky on the under surface; racemes arise from the base of the stem and creep on the surface of the ground around the clumps; fruits or capsules angled shorter and more globular than the Mysore type.

Mysore—Leaves larger with a coarser under surface not silky but hard and smooth; racemes rise erect; fruits oblong and larger than those of the Malabar type.

The two varieties differ slightly in flavour.

In Ceylon at the present time, about 7,000 acres are under cultivation. Of this area about 1,000 acres consist of small holdings up to 2 acres in extent belonging to the village population. The rest are plantations belonging to Estate companies and to individual planters, both European and Ceylonese. Estate scale plantations vary from 5 to 450 acres in extent, the latter figure representing probably the largest cardamom plantation in the Island. There are several plantations of over 100 acres each, and two or three between 200 and 300 acres. Cardamoms are cultivated in Ceylon only in the higher, moist elevations.

The quantities of cardamoms exported during the last five years and their value are noted below. It will be observed that the prices have varied considerably.

	Quantity in Cwts.	Value in Rupees.
1933	3,161	338,096
1934	3.441	355 960
1935	2,362	274,751
1936	2,335	425,907
1937	2,890	685,736

Cardamoms are grown very extensively in Mysore and the cultivation of the crop has been started in Sumatra.

The world's requirements of cardamoms appear to be limited, and question naturally arises: is it advisable to extend the cultivation of cardamoms?

The chief use of cardamoms is as a spice. In the East cardamoms are used extensively as a masticatory and, particularly in India, as an aphrodisiac. They are also used medicinally as an aromatic, stimulant and diuretic. On the continent of Europe, the capsules are crushed and mixed with flour and baked into bread noted for its warmth-giving properties.

Elevation and rainfall for cardamoms. Elevation and rainfall are important factors for the successful cultivation of cardamoms. The elevation best suited for the Malabar variety is between 2,000 and 3,500 feet above sea level and for the Mysore variety between 3,000 and 4,500 feet, with a well distributed rainfall between 120 and 150 inches per year. It would be a venturesome proposition to grow cardamoms for commerce at lower or higher elevations than these.

Soil and situation. Well-drained, fairly deep, moist, rich loamy soils such as are found under high forests on undulating situations are the most suitable. Cardamoms will thrive best on such soils under light natural shade and when protected from strong wind. The sloping high hills of Medamahanuwara, Knuckles, Rangala, Kotmale, Dolosbage and Balangoda have some of the best plantations.

A stiff clayey soil which remains excessively wet and a light or sandy, rapidly drying soil are unsuitable. The areas truly satisfactory for cardamoms are limited in Ceylon and it is probable that very little more land could be cultivated successfully with the crop.

Propagating and planting. Though propagation can be effected by seed. It is generally done by division of the crown of rhizomes, or "bulbs" as they are called. Bulbs for planting have to be carefully selected. They should be 18 months to two years old, and should contain at least two growing stems. Any damaged bulbs should be rejected and bulbs for planting should not be kept in the open for more than a few days after lifting.

It is not uncommon to plant entire plants separated from old clumps. If this method of propagation is adopted, care is necessary to see that each plant has its proper proportion of rhizomes to put forth new stems.

The most suitable distance for planting is 8 feet apart. Holes or pits for each bulb or plant should be prepared well ahead of planting: they should be 2 feet wide and 1 to 1½ feet deep and filled up with surface soil and allowed to "weather" for 2 or 3 weeks. Too deep or shallow planting of bulbs results in casualties. The bulbs should be buried up to their collars and the soil pressed down firmly with the hands.

Where bulbs are difficult to obtain, propagation by seed is recommended. Fruits from which the seed for growing is intended, should be selected. They should have attained full maturity. Seeds which are compact and adhering in a mass should be air-dried and separated, soaked in water for two hours and sown in a well prepared nursery bed. The finer the texture of the nursery bed, the better it is. A better practice is to raise seedlings in boxes containing a good mixture of fine leaf mould and sand. The soil in the nursery or seed boxes should be kept damp and protected from excessive heat of the sun and, if in the open, protected from direct rain. In about a year the seedlings will have grown about a foot in height when they may be lifted carefully and planted out.

Seeds, as stated before, may take two or three months to germinate. At lower elevations it has been found that seeds germinate in less than a month. The germination is generally poor. It is, therefore, advisable to sow about 1 lb. of dry seed to raise enough seedlings to plant up one acre, although many more plants than the 600 required may be obtained from one pound of seed.

After cultivation. Very little after cultivation is required. weeding may be necessary at intervals for about two years after planting out at lower elevations and for about three years at higher elevations. Once the bushes are fully formed they will keep down weeds and an occasional weeding once in two months or so only is necessary. Dry leaves may be removed which should not be thrown away but put round the clumps. Decaying or any damaged leaf stalks must be carefully cut off leaving about 2 feet of stalk. Do not injure the root stock.

There is no local experience regarding manures suitable for cardamoms. Experiments have been made with artificials with no success. Experience has shown that it is best to let the leaves that fall on the clumps remain undisturbed except when rotting of the root stock is discovered.

Crop and Harvest. At lower elevations cardamoms usually come into bearing in two years and at higher elevations after the third year. The early crops are small. From about the fifth year full crops of 1,000 to 1,500 pounds of green cardamoms may be expected per acre, for some years. Heavier yields than these have often been obtained. At lower elevations, crops will begin to decline after about six years. At higher elevations good crops may be expected for about 10 years; the yield gradually falls off for the next ten years, after which a crop of 50 lb per acre will be found to be the average.

Although flowering may occur all the year round, the main flowering season is from April to July and harvesting may begin in August and last up to December. The heaviest crops are gathered from October to December.

Fruits are borne in succession in the same racemes. It is therefore necessary to pick individual fruits very carefully as they mature by cutting them off with a pair of scissors without damaging the racemes bearing the blossom. From the flower to the mature fruit the period is about five months at higher elevations and about three to four months for lower elevations. Rounds of picking should be made once in three weeks to a month.

On ripening, cardamom fruits change their colour from green to a pale green. It is advisable to pick the fruits just before they fully ripen as over-ripe fruits are liable to split in curing.

Green Curing of Cardamoms. The old methods of curing cardamoms by bleaching are now being replaced, by progressive growers, by green curing which is superior in many ways. The old laborious procedure of sulphur smoking, sun-drying, soaking in water, sulphur smoking again and repeating these processes several times before a marketable commodity could be obtained, was not only expensive but required constant care and attention and depended largely upon weather conditions. Green curing is independent of the weather, requires less labour and a further advantage is that green cured cardamoms command a higher price.

Two methods of green curing are in use in Ceylon at the present time.

1. Drying in a heated chamber, the heat being generated by an external furnace and conducted through the chamber by means of flues.
2. Drying over an open charcoal fire in a closed chamber.

Either method gives equally satisfactory results. The open charcoal method is recommended as simpler, less expensive and therefore more capable of adoption by small holders.

In neither case is a solid chamber of brick and stone necessary. Walls of wattle and daub plastered and white-washed, or even of wooden planks are adequate. The chamber should be provided with a ceiling and the door should be close-fitting to conserve the heat. A window for the admission of light is desirable but not essential. In the case of chambers for the open charcoal firing method, ventilation is very necessary to carry off the fumes and should be provided.

A hot-air chamber may be a building with inside dimensions of 15 ft. by 15 ft. The ceiling is at the height of 8 feet. On two sides are racks for trays. The trays are of simple construction consisting of ordinary reeper frames with wire mesh or hessian bottoms. A convenient size for trays is 2 ft. 6 in. by 2 ft. 6 in., the racks being built to permit of easy admission and removal of the trays.

The racks are arranged in tiers being 8—9 inches apart.

Attached to the room is the furnace which is fed from outside. This may be 3 ft. by 3 ft. and 4 ft. high. From the furnace the hot air is carried along heating flues which lie a few inches above floor level, smoke escaping from the chimney.

This constitutes a complete hot-air curing barn and the space is sufficient for a crop of 4,000 to 4,500 lb. (dry weight) per annum. Outside the room is a store in which the dried or cured cardamoms are stored. Rat-proof boxes or bins are essential for storing cured cardamoms until they are ready for despatch.

The open fire chamber may be made in a building of any convenient size. Along two sides are firing places. The trays of cardamoms are placed at the top. The charcoal fire is lit within the chamber which should allow of admission of air. The room should be closed but ventilators should be provided to allow of the escape of fumes. Rack is provided for the reception of trays of cured cardamoms where they remain for some days to complete the curing or drying process.

Curing process. In curing by the hot-air process of flue curing, care must be exercised in regulating heat. Too rapid drying is unsuitable. The process may be explained as follows:—

When the cardamoms are harvested and brought in, they are placed in trays (a tray 2 ft. 6 in. by 2 ft. will accommodate 8—12 lb. of green cardamoms) the trays being then placed in the racks. The furnace is then fired. The consumption of firewood should be about ½ cubic yard of good hard firewood for every 1,000 lb. of green cardamoms. The cardamoms are allowed to dry for about 30 hours at a temperature of about 180°F. Occasionally the trays are withdrawn

and the cardamoms turned over. After about 12 hours of drying the bottom and the top trays are exchanged to enable the trays to receive the same degree of heat during process. When cured, the cardamoms should be hard and greenish in colour.

In the open fire method the cardamoms are spread on trays with a wire mesh bottom, and placed over a slow burning charcoal fire for about 12 hours. They are then transferred to trays with a jute hessian bottom and placed on a higher rack for another day. By this time the cardamoms should have dried sufficiently, but to ensure complete drying, the trays are removed to stand in the same room.

The fire is lit on the floor of the chamber, charcoal being piled into heaps of about 1½ ft. in height. Approximately one pound of charcoal is required to dry each pound of green cardamoms.

Clipping. The dried cardamoms require clipping before they are marketed in order to remove all stalks and calyces. The common method of clipping with scissors can be replaced quite efficiently by rubbing the dried cardamoms over a coarse surface of jute hessian or wire mesh. This can be done more satisfactorily while the cardamoms are still hot For this purpose the dried cardamoms are further fired by placing them over the charcoal fire or hot air chamber, as the case may be, for about two hours and then rubbed on hessian or wire mesh surface.

Sorting. The next step is sorting. Sometimes a sieve with quarter inch mesh is employed for the purpose, but hand picking is more reliable. Damaged, shrivelled and very small capsules are removed for the extraction of seed. It might here be stated that the proper time for harvesting the crop is shortly before the capsules ripen. If allowed to ripen fully the capsules split and shed seeds in the process of drying.

Grading. The sorted cardamoms should be graded according to size and colour, being known in the trade as " Longs " " Mediums " and " Shorts ". Green cured cardamoms should be of an even greenish yellow colour. At no time during the drying process should they be exposed to any strong light which tends to bleach them and spoil the uniformity of colour.

Packing. For export, the cured cardamoms should be packed in aluminium and paper lined cases, taking about 112 lb. net, perferably in venesta cases.

The practice of packing cardamoms in double sacks, which is common in Ceylon, is to be deprecated owing to the danger of damage by rats.

General. The yield of cardamoms varies considerably with the age of the plantation, the nature of the soil and weather condition. Some plantations yield as much as 2,000 lb. of green cardamoms per acre in a good year. A yield of about 1,200 lb. is considered a good crop The return of cured cardamoms is usually 25 to 28 per cent. of the green weight.

The prices of cured cardamoms have varied in the last three years between Rs. 1·05 and Rs. 2·10 per lb. (*The Tropical Agriculturist*. Vol. XCI. No. 6, Dec. 1938).

EXTRACTS

The Cashew (*Anacardium occidentale*). During very recent years the cashew has been creating a new interest, chiefly because of the nut which is finding its way into commerce. This tree is native to Brazil and possibly other parts of tropical America. It certainly became wide-spread on this continent and the West Indies at a very early date and for centuries past it has been growing in warm regions of the Eastern hemisphere also. By the native people of all these countries, it has been prized for the fleshy portion of its fruit and for the seed

which is very curiously placed outside of the flesh or, in common parlance, the "nut" which grows on the outside of the "fruit." As a fruit, the cashew is used in many ways in the countries where it is grown, including dessert, fruit-punch and an alcoholic drink. The fruit is very perishable and cannot be shipped long distances but finds its way to local markets in considerable quantities. It is the seed or nut, however, which in recent years has been bringing the cashew into prominence The cashew nut has always been appreciated in the countries where the tree grows but it is only recently that it has found its way into world commerce. This new development appears to have been due largely to the discovery of processes of packing by which the nuts can be transported to any country without deterioration or insect attack. These nuts are now packed by a patented process in tight containers from which the air is exhausted and replaced by gases, said to be chiefly carbonic acid, in which they are prefectly preserved. Information received from the Bureau of Foreign and Domestic Commerce of the United States reveals the fact that 10,262,916 pounds of cashew nuts were imported into the United States in the year 1931. These were entered at a value of $ 2,052,240 which intended to represent their market value in the principal markets of the country which exported, including the cost of containers or coverings and all expenses incidental to placing the merchandise in condition ready for shipment to the United States. In 1932, the imports were slightly under 9,800,000 pounds which represent a very small shrinkage compared with the general falling off in trade in that year of general business depression.

It is worthy of note that nearly the entire importation comes from British India and not from its home in tropical America. Considering the fact that the cashew grows almost as a weed in Panama and yields abundantly even in rather poor soils, it would appear that attention should be given to the possibilities of developing a cashew industry here much nearer to the market. To do this it would be necessary to interest the importing companies in stimulating trade and production here. The climate, the soil, the proximity to market and the facilities for shipping are all in favour of such an industry.

The Canal Zone Experiment Gardens have introduced several varieties of cashew of unusual size and appearance all of which are doing well and yielding abundantly. They are now in correspondence with Brazil in an effort to get some of the best varieties from that country which is believed to be the home of this fruit and which probably makes a wider use of it than any other part of the Western hemisphere. (*The Planters' Chronicle*, Vol. XXXIV, No. 3, February 1939).

Gleanings.

Bacterial Wilt and Soft Rot. Bacterial wilt and soft rot has been responsible for serious losses in widely separated potato areas every effort should be made to see that it does not become more wide-spread. Racicot in Canada, Bonde in Maine, Burkholder in New York and Eddins in Florida have made valuable contributions to our knowledge of the disease. The information available as the result of their researches has been of very great value in guiding our efforts to eradicate this threat to the crop.

In our endeavor to prevent the spread of this disease we must not overlook the valuable contributions made by those in charge of seed potato certification. In one of the north-eastern states, for example, in the Spaulding Rose variety, twenty-eight per cent of the acreage was rejected because of this disease in 1937. In 1938, only 3·3 per cent of the acreage planted with this variety showed any of

the trouble. Drastic action on the part of the certification officials was responsible for bringing about this reduction. Two years ago when the seriousness of this disease was first fully appreciated, the certification authorities agreed to reject any field in which the disease was found. This year, despite the fact that many fields entered for certification passed all other requirements they were rejected because as few as one or two plants infected with bacterial wilt and soft rot were found. This required a high degree of courage on the part of the certification officials since it resulted in a serious loss to the seed growers.

All those interested in the potato industry appreciate what the men in charge of seed potato certification are doing to produce good seed potatoes. These men are on the firing line. It is they who must see that the recommendations of the research workers are carried out. In some cases in their efforts to do so their jobs are in jeopardy. If they are to succeed in their efforts to produce high class seed potatoes they must continue to have the advice and support of the plant pathologists. (*American Potato Journal*, Vol. 16, No. 1, page 1).

Cashew Oil and Mosquitoes. The Haffkine Institute, Bombay, recently undertook an investigation to discover a suitable toxic substance which, added to the oil film, produced rapid death in a large number of larvae and pupae within as short a time as possible. It was found that the addition of cashew nut-shell oil to kerosene or high.speed Diesel oil increased their killing power three times when tested under laboratory conditions. This activation of the oil at the same time proportionately decreased the cost of the anti-mosquito measures. Working with larvae and pupae of *Armigeres obturans*, a culcine mosquito commonly occurring in Bombay, it was found that while 3 ml. per square foot of kerosene oil alone was necessary to obtain a 100 per cent. kill, 1 ml. of mixture of 5 parts of cashew nut-shell oil and 95 parts of kerosene of high-speed diesel oil was adequate for the purpose. India at present holds a monopoly of cashew nut-shell oil, which is obtained as a byproduct during the production of cashew nut kernels. The tree, *Anacardium occidentale*, originally introduced from South America, has well established itself in the coastal forests of India. The oil referred to above is used for painting wood, as a protection against insects, and is exported to America and Europe for paint mixtures. (*The Planters' Chronicle*, Vol. XXXIV, No. 3, February 1939.)

Washing Dirty Eggs. Experiments conducted at the Missouri Agricultural Experiment Station have at last over-come the problem of dirty eggs. When washed in the ordinary way the eggs could always be picked out because the "bloom" of the shell was removed in the process and washed eggs never kept so well in cold storage and always commanded a lower price. It has now been found that if washed in lye made from 1 oz. caustic soda to a gallon of water the eggs kept well in cold storage as did naturally clean eggs of similar quality. When sold they commanded a price equal to that received for naturally clean, unwashed eggs.

Furthermore, experienced dealers in eggs could not detect the eggs which had been washed; and cooking tests after eight and ten months' storage showed that the dirty eggs which had been washed in lye water were of equal quality to the clean eggs stored at the same time.

Because of the caustic properties of the lye solution, rubber gloves should be used when washing the eggs, but the fact that soiled eggs can be treated in such a way as to reduce to a minimum losses due to their becoming dirty, suggests a possible solution to this vexing problem of how to handle dirty eggs. (*Rhodesia Agricultural Journal*, Vol. 36, No. 1, pp. 4).

Zinc sulphate as a fertiliser for wheat. According to the *Pastoral Review*, a new line of research is being undertaken by the Department of Agriculture of

Victoria to investigate the surprising results obtained from the application of very small dressings of zinc sulphate to wheat lands The effect was first noticed by research officers of the Department when testing this chemical against the eelworm of wheat. It will be interesting to learn whether the effect is due to zinc deficiency in the soils or whether some other factor is involved. At Nhill the addition of 30 lb. zinc sulphate per acre has produced spectacular increase in yield of from five to 9·4 bushels, and at Longerenong an increase of 2·1 bushels has been obtained. Zinc sulphate costs about £ 23 per ton, so a dressing of 30 lb. per acre would run to about 6 s., which leaves a good margin for profit. Why the chemical increases the yield is not clear, and as the discovery is yet in its infancy, farmers are advised to be chary with its use outside trial areas. It has been demonstrated in the Victorian Wimmera that light applications cause the wheat to mature exceptionally early. (*Rhodesia Agricultural Journal*, Vol. 36, No. 1, pp. 4—5).

Agricultural Jottings.

A SIMPLE DEVICE FOR COVERING SEED SOWN WITH THE DRILL

In the black soil tracts of the south the chief crops grown are cotton and *cumbu* besides *cholam* raised for fodder. The general method of sowing is to broadcast the seed and cover it with the country plough. The practice of drill sowing is also being followed by a number of cultivators.

2. At the Agricultural Research Station, Koilpatti, the crops are always sown with the drill. Originally a two-tyned gorru with tynes 18" apart was used for sowing cotton and *cumbu*. Although this is an improvement over the local method it was found capable of considerable improvement since the area covered by this was not appreciable, the draught was too light for an ordinary pair of bullocks, and it was also noted that the implement was rather unsteady and had a tendency to work deeper than necessary. As a consequence this was replaced by a three-tyned drill to start with and then quickly changed to a four-tyned one to make it more economical. This four-tyned *gorru* would cover an area of 12 acres in a day of 8 hours. With the development of the drill the ordinary sized *guntaka* with a 3' blade could not cope up for covering the seed and therefore the width was increased to 4½ feet to keep pace with the four-tyned drill.

3. To get the proper germination either in cotton or in *cumbu* it is highly important that the seed has to be sown as shallow as possible at a depth of not more than two inches. The covering implement that follows should work in such a way that the seed deposited in the furrows is not lifted. To achieve this the *guntaka* has to be very near the yoke so that the blade just moves on the surface of the soil and therefore it will have to work in the space between the two animals. This requires the provision of a long yoke to allow sufficient space and avoid the feet of the animals being hurt. Under the prevailing conditions of the soil at the time of sowing it is not necessary to work the blade since the operation is intended only to put back into the furrows the soil lifted by the tynes of the drill. Any straight piece of wood or iron would serve the purpose quite well but a certain amount of weight is essential to adjust to the slight irregularities in the level of the field. A piece of angle iron was found to satisfy these conditions.

4. A 2"×2"×¼" angle iron, 18 feet long, was cut into two pieces of 9 feet each. In one of the arms of the angle two holes of ½" size were drilled at a distance of 3 feet apart in the middle. To these holes the two ends of an ordinary plough chain were hooked and it was tied to the yoke pole. To the other arm of the angle a handle was fixed. The weight of the whole implement

including the chain is 40 lbs. and it costs Rs. 3—13—0 each complete. It is an easy work for a small pair of animals and a comfortable job for a lazy driver. The ordinary *guntaka* costs Rs. 3/- but covers only half the area with the advantages mentioned above.

5. The advantages in this new device are :—

(a) It is extremely simple in design and needs no skill either in making or working it.

(b) It covers a large area and copes up with two four-tyned drills and thus saves a pair of bullocks and a man.

(c) The risk of lifting the seed from the soil is avoided.

(d) There is no necessity to have a long yoke pole and there is absolutely no danger of any injury to the animals' feet.

(e) The covering is very efficient. The experience shows that it can safely be recommended to any cultivator who adopts drill sowing.

Crop and Trade Reports.

Cotton—1938-39—Fourth Forecast Report. The average of the areas under cotton in the Madras Province during the five years ending 1936-37 has represented 9 6 per cent. of the total area under cotton in India.

2. The area under cotton up to the 25th January 1938 is estimated at 1.873,900 acres. When compared with the area of 2,512,000 acres estimated for the corresponding period of last year, it reveals a decrease of 25·4 per cent.

368,500 acres have been reported as sown since the last December forecast was issued. This extent is made up of 235,000 acres under Tinnevellies, 62,000 acres under Northerns and Westerns, 44,400 acres under Cambodia, 14,100 acres under Cocanadas, 12,400 acres under Salems and 600 acres under other varieties of cotton. The area sown in December and January falls short of that sown in the corresponding period of the previous year by 24,900 acres or by 6·3 per cent.

3. The decrease in area in the current year as compared with the area in 1937-38 occurs in all the important cotton-growing districts of the Province and is attributable largely to unfavourable seasonal conditions.

The area under irrigated cotton mainly Cambodia is estimated at 162,200 acres as against 271,700 acres for the corresponding period of the previous year, a decrease of 40·3 per cent.

4. Pickings of the mungari or early sown cotton crop in the Deccan have concluded. The yield was normal on the whole.

The crop was affected by the failure of the northeast monsoon rains and yields below normal are reported from all the important cotton-growing districts except Kurnool and Anantapur where the yield is expected to be normal. The estimated yield is lowest for dry cotton in Coimbatore (75 per cent) owing to the attack of insect pests and diseases.

5. The seasonal factor for the Province as a whole works out to 94 per cent. of the average as against 80 per cent. in the previous year. On this basis, the total yield is estimated at 375,800 bales of 400 lb. as against 488,600 bales for the corresponding period of the previous year. It is, however, too early to estimate the yield with accuracy as the harvest has not yet commenced in the major portion of the area and much will depend upon the future weather conditions and the toll taken by insect pests

6. The estimated area and yield under the several varieties are given below:-

(Area in hundreds of acres, i. e., 00 being omitted; yield in hundreds of bales of 400 lb. lint, i. e., 00 being omitted.)

Variety.	Area from 1st April to 25th January.		Corresponding yield.	
	1938-39	1937-38	1938-39	1937-38
	Acs.	Acs.	Bales	Bales
(1)	(2)	(3)	(4)	(5)
Irrigated Cambodia ...	153,0	259,7	87,9	158,6
Dry Cambodia	178,4	306,2	34,1	62,7
Total, Cambodia ...	331,4	565,9	122,0	221,3
Karunganni in Coimbatore	57,2	137,0	10,5	29,7
Uppam in the Central districts	18,6	32,0	2,7	4,9
Nadam and Bourbon ...	3,3	25,2	2	1,2
Total, Salems ...	79,1	194,2	13,4	35,8
Tinnevellies *	458,0	529,5	112,1	123,9
Northerns and Westerns	882,0	1,086,0	106,8	84,1
Cocanadas ...	117,6	129,4	20,8	22,6
Others	5,8	7,0	7	9

* Includes Uppam, Karunganni and mixed country cotton in the south.

7. The average wholesale price of cotton lint per imperial maund of 82⅐ lb. as reported from important markets on 6th February 1939 was Rs. 15--1--0 for Cocanadas, Rs. 14--13--0 for red Northerns, Rs. 13-7-0 for white Northerns, Rs 12 for Westerns (mungari crop), Rs. 13--9--0 for Westerns (jowari crop), Rs. 24-15-0 for Coimbatore Cambodia, Rs 18--14--0 for Southern Cambodia, Rs. 21--10--0 for Coimbatore Karunganni, Rs. 18--14--0 for Tinnevelly Karunganni, Rs. 17 for Tinnevellies and Rs. 17--14--0 for Nadam cotton. When compared with the prices published in the last report, i e, those which prevailed on 9th January 1939, these prices reveal a rise of about one per cent. in the case of Coimbatore Karunganni and a fall of about eight per cent. in the case of Southern Cambodia and Tinnevellies, six per cent in the case of Westerns (mungari crop), five per cent. in the case of Tinnevelly Karunganni and one per cent. in the case of Coimbatore Cambodia, Westerns (jowari crop) and Cocanadas; the prices of Northerns (red and white varieties) and Nadam cotton remaining stationary.

(From the Director of Industries and Commerce, Madras).

Cotton raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 17th March 1939 amounted to 30,222 bales of 400 lb. lint as against an estimate of 375,800 bales of the total crop of 1938-39. The receipts in the corresponding period of the previous year were 40,319 bales. 48,000 bales mainly of pressed cotton were received at spinning mills and 15,380 bales were exported by sea while 30,997 bales were imported by sea mainly from Karachi, Egypt and Bombay.

(From the Director of Agriculture, Madras.)

Correspondence.

Agricultural Propaganda.

To

The Editor,

Madras Agricultural Journal.

Dear Sir,

Nice songs on agricultural improvements are sure to impress the listeners. Gramophone and the Radio might be useful for agricultural propaganda; but in the present day (be it in the town or village) the cinema theatre is the main attraction for the crowds and the talkie films are becoming increasingly popular. We can now find touring cinemas visiting even the remotest villages and showing films to audiences composed mostly of agriculturists. Nothing will be more impressive or effective than a short talkie film on some particular agricultural improvement shown at these village cinema theatres in the right time and season.

The Government and the philanthropic gentlemen of this province will be doing a distinct service to the agriculturists if they can help in the production of such films relating to local agricultural conditions. The proprietors of the touring cinemas will be only too glad to show these films free of any cost.

Chandragiri, 18—2—'39.

K. Raghunada Reddy,
Agricultural Demonstrator.

To

The Editor,

Madras Agricultural Journal.

Sir,

I heartily endorse the methods advocated for Agricultural propaganda work by the " Member of the Madras Agricultural Students' Union " in your issue of January 1939. May I refer the member to my paper on " A much needed link in Agricultural dissemination work " read before the last College Day and Conference (vide Madras Agricultural Journal 1938 XXVI No. 9 pages 319—329). where I have stressed the important role the gramaphone records and auto-truck movies or talkies will play in the agricultural propaganda work.

Let me give my little personal experience I had when I was in charge of the Exhibition Van for a short period in the year 1932. To have some past-time in the remotest villages the touring Veterinary Assistant who accompained me casually thought of bringing his private gramaphone set with him But lo! it worked miracles. When the switch was off the poor folks returning from the hum-drum of village life used to gather in such large numbers that we found very little difficulty in getting a good audience for all our exhibitions and lantern lectures; Gramaphone records will therefore be a great asset to the Agricultural Demonstrators. Semi-private agencies like the one working in Bombay should be encouraged by the state in preparing records on agricultural subjects.

But, I believe that in these days of Cinema fad auto-truck movie or talkie will do better and quicker work. It will create a better and more lasting impression in the minds of villagers. The Horlics Co., and the Lux Toilet Soap Co., are using such auto-trucks only. The Negro Extension scheme in America is worked with the help of such motor units. In this connection I refer the readers

to the book on "The American and the Cinema" by L. A. Notcutt and G. C. Latham; also to the article in the Empire Cotton Growing Review, Vol. XV, 1938 on the use of films in African agriculture by the latter author. The book gives a full account of the success of films in the African villages and its appendix describes how easy and cheap it is to prepare films in India. Talents are not wanting in India. Even in our own province, thanks to the efforts of our Ex-Director, Sri S. V. Ramamurty, some two dozen plays, both in Tamil and Telugu, were written and the best of them awarded gold medals. The Tamil play written by Sri S. Rajarathnam was even enacted during one of our College Day and Conference and was much appreciated. The Tamil and Telugu plays are worthy of being printed and filmed. The Cinema owners will be only too glad to put these short plays on the screen just before their daily shows. Mr. Latham, in the article referred to above, estimates the cost of portable unit with a sound-on-disc and an amplifier as £ 80 only. A unit of this kind can, with advantage, be easily attached to the Motor Exhibition Vans run by our Agricultural Department.

Lawley Road
20—2—'39. N. C. Thirumalachary.

Association of Economic Biologists.

The Annual General Body meeting of the above association was held on the 24th February 1939, under the presidentship of Rao Bahadur V. Ramanatha Ayyar. After the accounts for 1938 and the budget for 1939 were passed the following office-bearers were elected:

President; Rao Bahadur T. S. Venkataraman, B.A., C.I.E., I A.S.

Resident Vice-President: Sri. M. C. Cherian.

Moffusil ,, ,, Dr. J. S. Patel.

Secretary: Sri. C. R. Srinivasa Ayyengar.

Members of the Committee: Rao Bahadur V. Ramanatha Ayyar.
Sri. K. M. Thomas.

Sri. V. Gomatinayagam Pillai was elected auditor.

The incoming President then took the chair. In the absence of Dr. J. S. Patel, the retiring president, his address on "Groundnut in Madras" was read by Rao Bahadur V. Ramanatha Ayyar. With a vote of thanks to the retiring Committee, the meeting terminated.

A public lecture was held under the auspices of the Association on 1—3—39 when Mr. D. N. Mahta, B. A. (Oxon), F. L. S., Secretary, Indian Central Cotton Committee, gave a talk on "Cotton Improvement Work in the Central Provinces". In the course of the talk, the lecturer said that the chief problem of his Province was the improvement of staple-length and the disposal of its surplus production. As a result of selection work during 1923-30 *Verum 262* which had good length and was at the same time resistant to wilt was evolved. It was however very much affected by climatological factors. Two other selections obtained subsequently, *Late verum* and *434* met this defect to a large extent—the former in places of heavy rainfall and the latter in less favoured regions. Summing up the lecturer said that the problem of disposal of surplus cotton in India required immediate attention, since Japan, the biggest consumer of our cotton was likely to turn to other sources of raw cotton. It was suggested that the solution of the problem should be sought not in a general curtailment of the area under cotton but in increasing our yield per acre and replacing the short-stapled types by long stapled ones.

College News and Notes.

Students' Club. The students' Club Day was celebrated this year on the 25th of February under the presidency of Sri O. Pulla Reddi, M.A., I.C.S. The function, which was well attended, commenced at 4-30 P. M. with tea and fancy dress competition after which the guests and students adjourned to the well decorated Freeman Hall. The reports of the Library and Games sections of the Students' Club were presented by the respective Secretaries The president distributed the prizes to the winners in the various games and tournaments conducted in connection with the Club Day " The Club Day Rag ", which was then presented, was much appreciated by the audience. This was followed by a variety entertainment. The happy function terminated with the Presidential address, followed by a vote of thanks proposed by the Principal.

Cricket. The last match of the season was played against the Anamalais Club at Valparai. Batting first, our College was unlucky to score for the first time below 100. Our team made only 97, but thanks to the fine efforts of Dinker Rao and Kothandaraman with the leather, the home team was skittled out for 73 after they made a good start.

Visitors. Sri P. H. Rama Reddi, M.A., I.A.S., Director of Agriculture, Madras, arrived here on the 3rd and camped till the 6th inst. when he left for Madras.

Mr. D. N. Mahta, B.A. (Oxon) F. L. S., Secretary, Indian Central Cotton Committee was another distinguished visitor to the College. He was here for 3 days from the 27th February.

The late Sri. A. V. Tirumuruganatham Pillai.

We are sorry to record the sad demise at his residence in the Agraharam street, Erode, of Sri. A. V. Tirumuruganatham Pillai, Retired Assistant Director of Agriculture.

Born in April 1874, he took his L. Ag. diploma in the Saidapet Agricultural College and entered Government service on the 15th May 1896. He was appointed as Assistant Director of Agriculture on the 15th January 1918. He worked as Assistant Director of Agriculture at Vellore, Guntur, Madura and Trichinopoly. Once in 1920 and again in 1928 he held charge of the office of the Deputy Director of Agriculture at Madura and Guntur, respectively. Retiring on the 16th April 1929, Sri. Pillai engaged himself in beneficial public activities. He served as an honorary magistrate of the local first class Bench Court. As a Director of both the Erode Co-operative Land Mortgage Bank, Ltd., and the Co-operative House Mortgage Bank, Ltd., he did useful work. Of a pious disposition, he worked as a trustee of the local Kongalamman Devasthanam.

Even after his retirement he continued to serve as a moffusil Vice-President of the Madras Agricultural Students' Union.

We express our heartfelt condolence to the members of the bereaved family.

The late Sri. K. Vasudeva Shenai.

We are sorry to learn of the sad demise on the 4th February 1939 of Sri. K. Vasudeva Shenai, Agricultural Demonstrator, Coondapur, after an attack of pneumonia. At the age of 44, in the prime of youth, Sri. Shenai has been snatched away by death. A conscientious and able worker, he was liked by one and all.

Our sincere condolence to the members of his family.

Notifications.

The following letters received by the Principal, Agricultural College, have been forwarded to us, for publication in the Madras Agricultural Journal. Intending applicants may submit their application direct to the Officers concerned.

Copy of letter No. C 596/39 E dated 19th February 1939 from the District Forest Officer, Salem North, Hosur Cattle Farm.

"I am in need of 2 or 3 "FIELDMEN" to work under the Spike Research Ranger at Denkanikota. Their work will be mostly entomological—collecting, sorting and releasing insects in cages, killing insects, mounting them etc. Insects have to be collected in fields and in forest areas during day as well as during night, according to necessity. "FIELDMEN" come under "work-charged" establishment and belong to no service (neither permanent nor temporary). As "Fieldmen" they will be paid Rs. 30/- a month. If their work and conduct are found to be satisfactory in the course of 6 months or a year, they will be appointed as Temporary Foresters in the Madras Forest Subordinate service on a pay of Rs. 28/- plus Rs. 8—12—0 as Fixed Travelling Allowance, per mensem. Men qualified for Forester's posts are therefore necessary.

2. Qualifications for a Forester's post are :—

(a) Age :— Not more than 25 years on the date of appointment as Forester.

(b) Physical

Minimum height 5′ 5″

Minimum measurements round the chest } (a) on full expiration 32″ (b) on full inspiration 34″

(c) Educational, Madras S. S. L. C. with marks obtained at the Public Examination as specified below :—

	Brahmin, Non-Brahmin (Hindu), Anglo-Indian, Christian or Non-Asiatic not less than.	Others not less than
Group A.		
English	40%	35%
A. Language	40%	35%
Elementary Mathematics	35%	35%
Elementary Science	30%	30%
Outlines of History of England and India and Geography	30%	30%
Group C.		
In one of the subjects	35%	35%

3. Mr. Griffith, Provincial Silviculturist, informs me that you may be able to help me in the matter of finding suitable candidates for the posts of "Fieldmen" on terms set forth above. I shall be very thankful if you will very kindly put me on to such men that you may know or ask them to apply to me."

Copy of letter dated 25th January 1939 from the Imperial Chemical Industries (India) Ltd., Madras.

"We have a vacancy for a Telugu-born Graduate of the Coimbatore Agricultural College and should be much obliged if you could furnish us with a list of recent graduates who are still unemployed."

The following correspondence on the Training of Agricultural Research workers has been sent to us by the Director of Agriculture, Madras for publication in the Madras Agricultural Journal :—

Copy of letter No. F. 16-6/38-E dated the 26th January 1939, from the Secretary to the Government of India, Department of Education, Health and Lands, New Delhi, to all Provincial Governments and Local Administrations (including Andamans and Panth Piploda).

Training of Agricultural Research workers—Advice to Indian Students intending to proceed abroad to study Agricultural Science.

In continuation of this Department letter No. F. 16-6/38-E, dated 18th July. 1938, I am directed to forward for information and such action as may be deemed necessary, a copy of a letter No. D. 8006/38-AI, dated the 6th January 1939, with enclosures, from the Secretary, Imperial Council of Agricultural Research, to the Educational Commissioner with the Government of India, on the subject mentioned above.

Copy of letter No. D. 8006/38-AI, dated the 6th January 1939, from the Secretary, Imperial Council of Agricultural Research to the Educational Commissioner with the Government of India.

Subject :— *Training of agricultural research workers.*

I am directed to invite a reference to your endorsement No. F. 16-6/38-E, dated the 18th July 1938 and to forward herewith for information a copy of the marginally* noted correspondence with the Secretary, Students Advisory Committee in Sind.

*1. Letter from the Secretary, Students Advisory Committee, Sind, Karachi, No. S. 147/7875-A dated the 18th August 1938.

2. Letter to the Secretary, Students Advisory Committee, Sind, Karachi, No. F. 135/36-A, dated the 1st September 1938.

Copy of letter No S. 147/7875-A dated the 18th August 1938, from the Secretary, Students Advisory Committee, Sind, to the Vice-Chairman, Imperial Council of Agricultural Research, Rock House, Simla.

Training of Agricultural Research Workers.

I have the honour to state that some students who are in the final B. Sc. course at the Agricultural College, Poona intend going up for Research work to some foreign Universities. From your letter No. F. 135/36-A of 18-6-1938 addressed to the Educational Commissioner with the Government of India, I find

that there appears to be very good provision in your college for doing Research work in Agriculture for the Science Students. I would like to know for the benefit of students who have passed *B. Sc. in Agriculture* whether it will be equally profitable for them to pursue their research studies in your college rather than go to some foreign University. Apart from the question of provision of proper facilities for Research work, what they are specially anxious to know is whether the value of the degree acquired in your college will be equally helpful to them for securing Government service or any other service under state or some responsible Bodies as any foreign degree. As it is, an Indian student thinks lightly of Indian degrees because the Hall-mark of a foreign University helps him better to get Government service. I, therefore, request you to let me know whether there are any Government orders placing the M. Sc. degree of your institute on par with a similar degree of foreign Universities. I will also like to know the conditions of admission in your institute. For this purpose you might kindly send to me prospectus of the College and any other literature bearing on the point.

Copy of letter No. F. 135/36-A, dated the 1st September 1938, from the Secretary, Imperial Council of Agricultural Research, Simla, to the Secretary, Students Advisory Committee, Sind, Karachi.

Subject :— *Training of Agricultural Research Workers.*

With reference to your letter No. S. 147/7875-A dated the 18th August 1938, I am directed to say that the post-graduate course at the Imperial Agricultural Research Institute, New Delhi, leads to a post-graduate diploma and not to a degree. This diploma is a recognised qualification for service in the Agricultural Departments of this country and the diploma holders can, as a general rule, obtain employment without any difficulty, whilst the same cannot be said of all holders of foreign degrees. It has also been found from experience that men who have done best and gained most advantage from an advanced study in agriculture abroad are those who have worked in an Agricultural Department or a research institute in India before going abroad. The value of a foreign degree is much enhanced if it is preceded by the post-graduate course at the Imperial Agricultural Research Institute, New Delhi. You are therefore advised to send students to the Imperial Agricultural Research Institute for taking the diploma before sending them abroad for foreign degree.

For prospectus and further particulars of the post-graduate courses at the Institute you may please apply to the Director of the Imperial Agricultural Research Institute, New Delhi.

Weather Review—FEBRUARY 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·0	−0·7	0·0
	Calingapatam	0·0	−0·5	0·2
	Vizagapatam	0·0	−0·9	0·0
	Anakapalli*	0·0	−1·3	0·2
	Samalkota*			
	Maruteru*	0·0	−1·0	0·2
	Cocanada	0·0	−0·3	0·2
	Masulipatam	0·0	−0·4	0·0
	Guntur*	0·0	−1·1	0·0
Ceded Dists.	Kurnool	0·0	−0·2	0·0
	Nandyal*	0·0	0·0	0·0
	Hagari*	0·0	−0·3	0·0
	Siruguppa*	0·0	−0·3	0·0
	Bellary	0·0	−0·2	0·0
	Anantapur	0·0	−0·3	0·0
	Rentachintala	0·0	...	0·0
	Cuddapah	0·0	−0·1	0·1
	Anantharajupet*	0·0	0·0	2·9
Carnatic	Nellore	0·0	−0·1	1·0
	Madras	0·0	−0·3	0·7
	Palur*	0·0	−0·7	3·0
	Tindivanam*	0·0	−1·0	0·7
	Cuddalore	0·0	−0·9	3·5
Central	Vellore	0·0	−0·3	2·0
	Salem	0·0	−0·3	0·6
	Coimbatore	0·0	−0·3	2·3
	Coimbatore A. C. & R. I.*	0·0	−0·5	2·1
	Trichinopoly	0·0	−0·5	1·9

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	0·0	−0·6	1·4
	Aduthurai*	0·0	−0·5	2·4
	Madura	0·4	0·0	1·3
	Pamban	1·5	+0·8	3·3
	Koilpatti*	0·7	+0·2	2·6
	Palamkottah	0·2	−0·6	2·3
West Coast	Trivandrum	0·6	0·0	1·1
	Cochin	0·0	−0·8	0·0
	Calicut	0·0	−0·2	0·1
	Pattambi*	0·0	−0·5	0·0
	Taliparamba*			
	Kasargode*	0·0	−0·2	0·0
	Nileshwar*	0·0	−0·2	0·0
	Mangalore	0·0	−0·1	0·0
Mysore and Coorg	Chitaldrug	0·0	−0·1	0·0
	Bangalore	0·0	−0·2	0·6
	Mysore	0·0	−0·2	0·3
	Mercara	0·0	−0·2	0·9
Hills	Kodaikanal	4·8	+3·4	8·5
	Coonoor			
	Ootacamund*	0·1	0·0	1·4
	Nanjanad*	0·7	+0·1	1·2

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette

Except for a few isolated light showers in Southeast Madras on the 16th, 17th, 18th and the 23rd dry weather prevailed in the peninsula. Rainfall was generally in defect.

Skies were lightly to moderately clouded in Southeast Madras and clear or lightly clouded elsewhere.

Humidity was in defect. Temperatures were generally normal.

Weather Report for Research Institute Observatory.

Report No. 2/39.

Absolute Maximum in shade ...	...	93·0°F
Absolute Minimum in shade ...	...	56·8°F
Mean Maximum in shade ...	...	89·8°F
Departure from Normal ...	...	0·7°F

Mean Minimum in shade	...	...	64·8°F
Departure from normal	...	...	-1·0°F
Total Rainfall ...	...	...	Nil.
Departure from normal	...	...	-0·5"
Mean daily wind velocity	...	...	3·5 m. p. h.
Departure from normal	...	...	+0·75 m. p. h.
Mean humidity ...	...	...	65·7%
Departure from normal	...	...	-6·2%

Summary:— Weather was dry throughout the month. The skies were clear or lightly clouded. Rainfall was in defect by 0·5". The day and night temperatures were below normal. P. V. R. & J. C.

Departmental Notifications.

Gazette Notifications.

Appointments.

Sri L. Narasimha Acharya, Agricultural Demonstrator, Chittoor. is appointed to the Madras Agricultural Service in Category 6—to officiate as Assistant Director of Agriculture, Nellore, Vice Sri V. G. Dhanakoti Raju on leave.

The services of Sri T. Narayana Rao, Assistant in Millets, Agricultural Research Station, Guntur are placed at the disposal of the Government of India for appointment as Superintendent, Tobacco Sub-station, Guntur for a period of three years.

Leave.

Name of officers.	Period of leave.
Sri V. G. Dhanakoti Raju, Offg. Asst. Director of Agriculture, Nellore.	L. a. p. on M. C. for 3 months from 17—2—39.
,, R. Chokkalingam Pillai, Asst. Director of Agriculture, Tinnevelly.	L a. p. for 3 months from 3—3—39.

1. Appointments.

The following provisionally substantive appointments of upper subordinates in the Science section and Agricultural section in the III grade (new) are ordered with effect from 14th January 1938.

Science section :— Messrs. E. J. Varghese, N. G. Narayana and B. Suryanarayana Rao.

Agricultural section .— Messrs C. K. Ramachandran, M. L. Balasundaran P. Abdul Samad Sahib and K. C. Thomas.

2, Promotions.

The following provisionally substantive promotions of upper subordinates in the Agricultural section are ordered with effect from the 14th January 1938. From V grade to IV grade. Rs. 85—5—120 to Rs. 120—10—170.

Messrs. S. V. Doraiswami Ayyar. Farm Manager, Agricultural Research Station, Guntur and V. Chidambaram Pillai, Farm Manager, Agricultural Research Station, Koilpatti.

Transfers.

Name of officers.	From	To
Mr. P. Israel,	Offg. Asst. in Entomology, Coimbatore,	Temporary Asst., A. R. S., Anakapalle.
Sri K. Brahmachari,	Entomology Asst,. Nellore,	Temporary Asst., A. R. S., Gudiyatam.
„ C. Krishnamurthy,	Offg. Asst., Millets Section, Nandyal,	Offg. Asst., Entomology Section, Coimbatore.
Janab Ali Hyder Sahib,	A. D., Kudligi,	Offg. F. M., A. R. S., Siruguppa.
Sri K. Sriraman,	Offg. Assistant, Chemistry Section, Coimbatore,	Temporary Asst. in Chemistry, A. R. S., Siruguppa.
Mr. James Colaco,	Temporary Asst. in Chemistry, A. R. S., Siruguppa,	Offg. Asst. in Chemistry, Coimbatore.
Sri G. C. Balanna,	A. D., Koilkuntla,	A. D., Allagadda.
„ G. Konda Reddy,	A. D., Allagadda,	A. D., Tadpatri.
Janab Varsai Muhammad Sahib,	Offg. Upper Subordinate, Agricultural Section,	Offg. Asst. in Oil Seeds, Tindivanam.
Sri K. Tejappa Shetty,	A. D., Sugarcane Subsidy Scheme, Kalyanpur,	A. D., Coondapur.
„ S. V. Parthasarathy,	A. D., Tadpatri,	A. D., Chittoor.
„ V. G. Venkataramana Rao,	A. D., Palmanir,	A. D., Kudligi.
„ M. Krishnaswami,	A. D., Rayadrug,	Sugarcane Growers Co-operative Union, Hospet.
„ I. Sambasiva Rao,	A. D., Bezwada,	A. D., Chellapalli for Exhibition work.
„ K. Govinda Kurup,	A. D., Mudukulatur,	A. D., Parmakudi.

Leave.

Name of officers,	Period of leave.
Sri T. Seshachalam Naidu, A. D., Kaikalur.	Extension of l. a. p. for 18 days from 19—3—39.
„ S. Rama Rao, Sugarcane Growers Cooperative Union, Hospet.	Extension of l. a. p. for 1 month from 12—2—39.
„ C. S. Balasubramaniam, Asst. in Entomology, Cuddapah.	L. a. p. on m. c. for 10 days from 24—2—39
„ M. Narayana Ayyar, A. D.. Polur.	L. a. p. for 1 month from 15—3—39.
„ P. V. Samu Ayyar, A. D., Sankarankoil.	L. a. p. for 2 months from the date of relief.
„ P. R. Subramania Ayyar, A D., Udayagiri.	L. a. p. for 4 months from 3—3—39.
„ A. Shanmugasundaram, Offg. F. M., Aduturai.	L. a. p. for 31 days from 6—3—39.
„ Y. Venkataswami, A. D , Dhone.	L. a. p. for 21 days from 16—3—39.
„ S. P. Fernando, A. D., Bhavani.	Extension of l. a. p. for 15 days from 3—1—39.
„ A. G. Ramaswamiah, Asst. in Entomology, Coimbatore.	L. a. p. for 2 weeks from 6—3—39.
„ K. Gurumurthy, A. D , Chellapalli.	L. a. p. for 24 days from 13—3—39.
„ M. C. Krishnaswami Sarma, A. D., Sivaganga.	L. a. p. for 4 months from 15—3—39.

Sri. P. V. Subba Rao, A. D (on leave).	L. a p. for 3 months from 15–1–39.
„ V. K. Appaji, A. R. S., Palur.	L. a. p. for 24 days from 3–3–39.
„ C. A. S. Ramalingam Pillai, A. D., Ariyalur.	L. a. p for 4 weeks from 8–3–39.
„ A. Alagiamanavalan, A. D., Punganur.	L. a. p. for 27 days from 4–4–39.
„ A. M. Muthayya Nattar, A. D. (on leave).	Extension of l. a. p. on m. c for 30 days from 22–2–39.
„ N. G. Narayana, Asst., Mungari Cotton scheme.	Leave with allowance for 25 days from 12–4–39.
„ P. Naghadara, A. A. D., Madakasira.	L. a p. for 12 days from 6–3–39.
„ S. Veeravaradha Raju, A. D., Trivellore.	L. a. p. for 2 months from the date of relief.
„ N. Narayana Ayyar, A. D., Attur.	L. a. p. for 14 days from 21–2–39.
„ N. Raghava Rao, A. D., Narasannapata.	Extension of l. a. p. on m. c. for 4 months from 12–2–39.
„ G. J. Balraj, A. D., Pattukottai.	L. a. p. on m. c. for 3 weeks from 13-3-39.
„ K. Hanumantha Rao, A. D., Hospet.	L. a p for 2 months from 26–2–39.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during February 1939.

A. Books.

1. *Report on the Soil Survey of Cochin State.* Cochin Agri. Dept. Pub. (1938). 2. *The New Farming.* Robinson, D. H (1938). 3. *British Agriculture: A Report of an Enquiry.* Viscount Astor & Rowntree, R. S. (1938) 4. *Manual of Mushroom Culture.* Rettew, G. R., Etc. (1938). 5. *Electroculture—2 Volumes. (Pamphlets of the Mainpuri Electroculture and Fruit Growers Association).* 1935-38. 6. *Agricultural Holdings in the United Provinces.* Jain, B. E. (1937). 7. *Milk Records of Cattle in approved Dairy Farms in India.* Kartha, K. P. R. (1938). 8. *Cattle Fodder and Human Nutrition.* Virtanen, A. I. (1938). 9. *The Structure and Development of the Fungi.* Gwynne-Vaughan, H. C. I. & Barnel, B. (1937). 10 *Propaganda.* Lambert, R. S. (1938). 11. *Simplified Statistics.* Holman, L. J. (1938).

B. Annual Reports Etc.

1. Subordinate Officers of the Madras Agri. Department for 1937-38. 2. Nagpur, Agricultural College, Central Provinces, Agri. Department Report for the year ending 31st March 1938. 3. Report of the Central Provinces, Dept. of Agri. for the year ending 31st March 1938. 4. Sind Annual Report Agri. Dept. for the year ending 30th June 1937. 5. Proceedings of Association of Economic Biologists, Coimbatore, Vol. V, 1937. 6 Annual Report of the Indian Central Cotton Committee for the year ending 31st August 1938 7. Report of the Zoological Survey of India for 1935 to 1938. 8. Annual Administration Report of Hyderabad H. E. H. Nizam's Govt. for 1346 Fasli (6th June 1936 to 5th June 1937). 1938. 9. Annual Report of Canadian Seed Growers' Association for 1936-37. 10. Sierra Leone Annual Report of Agri. Dept. for 1937. 11. South Australia Report of Minister of Agriculture for the year ending 30th June, 1938. 12. Fifteenth Annual Report of Arkansas A. E. S. for fiscal year ending June 1938. 13. 24th Annual Report of Oklahoma A. E. S. for the year 1937. 14. Puerto Rico Experiment Station Annual Report for 1937.

C. New Periodicals.

1. Rural Electrification and Electro Farming. 2. Food Manufacture.

The Madras Agricultural Journal.

(ORGAN OF THE M A. S. UNION)

Vol. XXVII.] APRIL 1939 [No. 4.

EDITORIAL

The motion made by the Hon'ble Minister for Development for a grant of Rs. 20 lakhs for the Madras Agricultural department elicited a full discussion on the activities and the policy of the department. Such a frank discussion was welcome in that it gave those in charge of the Department a chance to learn what the representatives of the people think of the Department and for the Minister for Development to acquaint the Assembly with the recent achievements of the Department and to make a spirited defence of Government's policy. The old complaint that the great gulf between the experimental stations and the ryots remains unbridged was repeated. While this is partially true of Madras as of every province in India critics have to realise the immensity of the task before the Agricultural officers and the miserably inadequate finances at their disposal. The money spent on Agricultural research, education and propaganda in this province works at less than 6 pies per year per head of population and it could well be realised that the department cannot go very far with the limited means at its disposal. Despite this handicap there is one demonstrator for each taluk with a band of demonstration maistries under him. The research institute at Coimbatore is adding to its reputation by releasing new strains of seed and the results of several pieces of valuable research. It was gratifying thet several members of the Assembly thought it fit to congratulate the ministry on its achievements. Mr. Reid who produced in the Assembly hall a 300 page volume of the " Villagers' Calendar " offered special congratulations to the Department in being able to issue such a fund of valuable information translated into four languages at the nominal price of one anna per copy. It is indeed gratifying to us that there is an increasing interest displayed by the public in the matters of Agriculture and that despite the recent use of the axe in several quarters the department is ready to cope with such increased demand.

Border Effect on the Crop in Irrigated Sorghum.

BY G. N. RANGASWAMI AYYANGAR, F. N. I., I. A. S.,
Millets Specialist and Geneticist,
M. A. SANKARA AYYAR, B. A., B. Sc. Ag.,
and
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The summer sorghum crop is grown only under irrigation in Coimbatore. In forming the bunded plots for experiments, alleys between the plots are a necessity. The space between plots is indispensable to prevent the breach of one plot into the other, and the mixing of seeds. Part of the soil required to form the bund is scraped from the alley. The plants at the border of a plot thus get a two-fold advantage over those in the interior, the extra space, and the additional soil surface thrown over it from the alley.

It is well known that border plants manifest extra vigour. In the yield trials conducted in a summer season in irrigated plots the question arises whether the borders will not vitiate the results, if the differential response of varieties to spatial restrictions is considerable. The principle of including or excluding the borders needs to be settled. If the exclusion of borders is decided upon, to what extent in a plot must the term border be applied. It is also necessary to determine the effect of border on some important aspects, besides earhead yield, like straw yield. These are the problems discussed in this paper.

Review of previous work. In the yields of plots of kafir and milo in the crop rotation and cultural experiments at the Hays Branch Station in Kansas, it was observed that in general the outside rows of a plot yield more than the inside rows. The excess yield of grain from the outside rows as compared with the inside rows was proportionately much greater than the excess of yield of stover of the outside rows over the inner rows (Cole and Hallstead, 1926.)

Material and Method. At the Millets Breeding Station an experiment was designed in the summer of 1928 to determine to what extent the border effect is felt within a plot. Two different strains, A. S. 795 (yellow grain) and A. S. 1543 (white grain) were sown in two blocks. In each, there were 11 plots of length 70 links and these varied from 1 to 11 sowing lines per plot with two links between the lines. The space between the plots was 4 links The grain and straw yield, and the number of plants were recorded in each line; the height of each plant was also measured.

In the summer of 1933 two series of comparative trials, namely, yellow and white grain varieties were conducted. There were three strains in each series in eight randomized blocks. The plots were 79 links long and

14 links broad; each plot consisted of six sowing lines 2 links apart. The area of a plot was 1·1 cents. The space between the plots was 4 links. In the summer of the following year, four series of comparative trials, white, yellow and red grain varieties, were conducted. There were four strains in each series in 6 randomized blocks. The plots were 71 links long and 14 links wide with six sowing lines 2 links apart in each plot. The area of a plot was 1 cent. The space between plots was 4 links.

The six comparative trials are for convenience of reference here given by the series A, B, C, D, E, F.

The two marginal rows and the four inner rows were recorded separately for earhead yield, number of plants, and weight of straw.

The total variation in a factor is resolved into the components due to position, varieties, blocks, position variety interaction, and error, and the analysis of variance is adopted for testing the significance of the several variations. The level of significance is taken at P = ·05.

Discussion. Extent of the border effect in a plot and the influence of plot size. In the first experiment (1928 summer) described above, it is found (Appendices I & II) that only the outermost rows in a plot yield grain and straw significantly above the inner rows. The penultimate rows at either sides of a plot do not show any significant increase over the inner rows; neither does any subsequent row within. The term "border" should rightly be applied only to the extreme rows of a plot. The border influence does not extend beyond the first line. The least of the border rows in a plot is greater than the greatest of the central rows in respect of grain yield.

The size of plot was varied from ·14 cent to 1·54 cents, with the number of rows per plot varying at the same time from 1 to 11, to determine whether the plot size would influence the difference between the border and the inner rows. The correlations between these differences and the size of the plot are given below:—

Correlates.	*Correlation.* A. S. 795	A. S. 1543
Size of plot and the difference between border and centre rows in weight of grain.	·59	·27
do. do. in height of plant.	·28	·05
do. do. in weight of straw.	·12	·61

In all cases the correlations are not significant. By how much the border row excels the inner row does not seem to depend on the size of the plot.

Following the above conclusions that only the extreme rows constitute the 'borders' and that the size of plot has no influence on the border effect,

an analysis of border effect was undertaken on the data of the comparative trials of 1933 and 1934 described above. The border effect on earhead yield, average earhead weight per plant, straw yield and the height of the plant will now be discussed.

Earhead Yield. The first step is to examine whether the inclusion of borders of a plot alters the results arrived at from the inner row yields only, by the application of the analysis of variance method. The procedure is well known. Table I presents the results of the analysis of variance of earhead yield of a plot with and without the borders.

TABLE I. Summary of the Analysis of Variance of Earhead Yield with and without Borders.

Trial Series.	Whether varietal differences are significant or not.		Coefficient of variation per plot.	
	Border excluded.	Border included.	Border excluded. %	Border included. %
A	Not significant	Not significant	11 6	9·4
B	Significant	Significant	13·3	10·0
C	,,	,,	9 3	6·5
D	,,	,,	6 6	6 1
E	,,	,,	7 7	5·1
F	,,	,,	5·6	4·7

The coefficient of variation of the entire plot is always less than that of the plot with the borders excluded.

It is found that the conclusions arrived at by tests of significance on inner plot yields, are not altered by the inclusion of margins.

TABLE II. Summary of the Analysis of Variance of Earhead Yield comparing Border and Centre.

Trial Series.	Whether significant or not. Variation due to:—	
	Position (Border vs. Centre).	Interaction (Position Variety).
A	Significant	Significant
B	,,	,,
C	,,	,,
D	,,	Not significant
E	,,	,
F	,,	Significant

The second step in analysing the data of an yield trial is to find the relative merits of varieties. From Table II it is seen that the positional (border vs. centre) variance in all the cases deviates widely from the error variance, P being far less than ·05. The increase of the border row over the central row varies from 47 to 114%.

TABLE III. Earhead Yield with and without Borders.

Series.	Strain No.	Central Row Yield oz.	Border plus Central Row Yield oz	Increase of Border over Centre %
@A	A. S. 809	2526	2413	50
Yellow	A. S. 818	2504	2595	79
grain	A. S 805	2296	2318	69
@B	Mixture*	3414	3392	51
White	A. S 3023	2834	2887	61
grain	A. S. 1575	1832	1801	47
@C	A. S 1575	2132	2120	94
White	A. S. 391	1780	1817	103
grain	Mixture*	1744	1640	103
	A. S. 3106	1542	1479	79
D	A. S. 2095	2250	2236	93
White	A. S. 3023	2112	2125	98
grain	A. S. 1059	1948	2007	107
	A. S. 367	1908	1849	94
E	A. S. 1[illegible]95	1940	1898	81
Yellow	A. S. 809	1796	1738	77
grain	A. S. 2157	1646	1654	91
	A. S. 818	1422	1514	114
F	A. S. 389	2780	2726	62
Red	A. S. 841	2608	2694	81
grain	M. S. 1690	2464	2483	72
	M. S. 1688	2318	2267	61

* Mixture of A. S. 1539, A. S. 1540 and A. S. 1543.

@ Position X variety interaction significant.

In Table II there is found a significant interaction between position and variety in 4 out of the 6 series. A significant interaction will alter the relative yields of varieties as is seen from Table III, where the yields are given with and without borders, to a common total. In one yellow grain series, the increase of the border row over the centre row varies as widely as 50% to 79%. In view of these facts, it is recommended that the borders be excluded from the plots for arriving at right conclusions.

Earhead weight per plant. It was observed that the individual earhead was heavier in the borders than in the centres. It is seen from Table IV that the positional variance is significant. The interaction between position and variety is also significant with one exception.

TABLE IV. Summary of the Analysis of Variance of Earhead Yield per Plant in Border and Centre.

	Whether significant or not	
	Variation due to :—	
Series.	Position (Border vs. Centre).	Interaction (Position x Variety).
A	Significant	Significant
B	"	"
C	"	"
D	"	"
E	"	Not Significant
F	"	Significant

The increase of head weight in the border rows, is different in different varieties.

Straw Yield. In the trials of sorghum varieties, the produce of straw which is an important fodder, must be reckoned alongside the yield of grain. The border effect on this factor also must be known. Table V presents the results of the analysis of variance of straw yields at harvest. A border doubtless produces more straw than an inner row; the increase varies from 27 to 66 % (Table VI). The border effect on straw though considerable, is not as great as the effect on grain yield. This is as reported by Coles and Hallstead (1926) in kafir and milo experiments. The interaction between variety and position is in three cases significant and in three cases not. The recommendation to exclude the earhead yield of border rows in experimental trials is in fact general and holds for straw yield as well.

TABLE V. Summary of the Analysis of Variance of Straw Yield in Border and Centre.

Series.	Whether significant or not — Variation due to :— Position (Border vs. Centre)	Interaction (Position x Variety).
A	Significant	Significant
B	"	Not Significant
C	"	"
D	"	Significant
E	"	Not Significant
F	"	Significant

TABLE VI. Straw Yield—Border vs. Centre.

Series	Strain No.	Central two rows yield.	Border two rows yield.	Increase Border over Centre	Increase %
		oz.	oz.	oz.	
A	A. S. 818	5098	7890	2792	55
	A. S. 805	4592	6376	1784	39
	A. S. 809	4524	6216	1692	37
B	Mixture	3930	5226	1296	33
	A. S. 3023	3435	4400	965	28
	A. S. 1575	3883	4947	1064	27
C	A. S. 391	3944	6560	2616	66
	A. S 1575	3679	5776	2097	57
	Mixture	4228	6532	2304	54
	A. S 3106	5112	7392	2280	45
D	A. S. 2095	3984	6272	2288	57
	A. S. 367	4160	6496	2336	56
	A. S. 3023	4040	6272	2232	55
	A. S. 1059	3904	5568	1664	43
E	A. S. 818	5000	8288	3288	66
	A. S. 2157	5104	8144	3040	59
	A. S. 809	4992	7878	2886	58
	A. S. 1195	4760	7424	2664	56
F	A. S. 841	4068	6720	2652	65
	M S. 1690	4208	6424	2216	53
	M.S 1638	4216	6200	1984	47
	A. S 389	3872	5664	1792	46

Height of Plant. From the experiment laid out in 1928 and described earlier in this paper, the border rows were observed to be significantly taller than the inner rows, the increase going up to 5 per cent.

Summary. In irrigated plots, with space between, only the extreme rows on either side constitute the "borders." In grain yield, the weight of an earhead per plant and straw yield, the borders manifest a clear excess of vigour over the inner rows. The increase of a border row over a centre row in earhead yield varies from 47 per cent to 114 per cent, but it is less variable in straw being 27 per cent to 66 per cent. There is evidence of a significant interaction between position and variety for each of the above factors. The height of plants in the border show a slight but significant increase over those in the interior of a plot. By how much the border excels an inner row in yield is not dependent on the size of the plot.

Since bulk crops are practically all "centre" with negligible "borders", it is the yield of the centre that counts. In strip trials under irrigation the borders are an appreciable part relatively to centres. It is found that the borders could differentialy be affected and react on the centres. It is therefore recommended in all such experimental plots the border rows may preferably be excluded.

Border Effect in Irrigated Sorghum

APPENDIX I Average measurements per plant in each line.

A. S. 795. Yellow grain.

Plot No.	No. of lines per plot.	W. H. S.	Line Number.										
			1	2	3	4	5	6	7	8	9	10	11
1	1	W	82·5										
		H	215										
		S	11										
2	2	W	58 8	58·4									
		H	206	219									
		S	10	10									
3	3	W	62 2	40·5	45·2								
		H	214	203	211								
		S	9	6	7								
4	4	W	51·8	31·3	41 3	51 5							
		H	212	211	211	200							
		S	8	5	6	8							
5	5	W	55·0	36·6	30·7	46 8	53·8						
		H	205	211	210	224	230						
		S	8	6	5	7	9						
6	6	W	66·2	32·0	38 3	37·4	35·3	49 8					
		H	228	222	227	235	222	235					
		S	9	5	6	7	6	10					
7	7	W	58 3	33·8	43 3	39 3	40 3	45·6	53·7				
		H	229	223	233	240	232	239	235				
		S	10	7	7	7	6	8	10				
8	8	W	53·8	32·1	38·0	30·3	37·8	34 9	38 1	59·1			
		H	236	233	232	221	226	229	230	244			
		S	11	6	7	5	6	5	6	10			
9	9	W	56 2	44 7	43·0	37·5	34·7	30·6	30·1	40 3	52·3		
		H	210	219	223	227	218	220	219	236	242		
		S	8	7	7	6	6	6	7	8	10		
10	10	W	48·3	29·3	30·8	30·7	35·2	38·4	33 9	35·6	33·9	54·1	
		H	210	197	209	211	223	231	239	227	229	240	
		S	7	4	5	4	5	7	7	6	6	9	
11	11	W	60·9	32·7	24·7	27·9	21·1	26·7	21·0	21·5	22 5	23·3	47·6
		H	222	211	209	213	195	217	207	215	198	200	211
		S	8	5	6	6	9	5	5	5	5	5	8

W–weight of grain in gms., H–height of plant in cms. and S–weight of straw in lbs.

APPENDIX II

Average measurements per plant in each line.

A. S. 1543. White grain.

Plot No.	No. of lines per plot.	W. H. S.	Line Number. 1	2	3	4	5	6	7	8	9	10	11
1	1	W	73·1										
		H	196										
		S	6										
2	2	W	64 6	64·6									
		H	208	201									
		S	6	6									
3	3	W	57·4	37·0	58·4								
		H	205	202	205								
		S	6	4	6								
4	4	W	52·5	41 2	40·7	65·3							
		H	211	206	201	215							
		S	5	4	4	2							
5	5	W	62 5	37·0	45 4	39·9	57·6						
		H	217	215	226	212	221						
		S	7	5	5	5	8						
6	6	W	61·0	44·6	36·7	48·5	47·4	61 9					
		H	229	223	222	232	231	230					
		S	7	6	6	6	6	8					
7	7	W	68·5	49·9	48·4	45 0	44·6	43·1	56 8				
		H	239	236	238	241	234	231	234				
		S	8	6	6	6	6	6	8				
8	8	W	75·2	48·3	51 1	38·5	44·2	43·9	38·8	51·0			
		H	247	235	236	232	232	223	211	221			
		S	10	6	6	5	5	5	5	5			
9	9	W	70·3	46·9	39·4	47·1	41·7	44·2	49·6	50 9	53·6		
		H	231	236	236	230	231	230	241	239	232		
		S	9	7	5	6	6	7	6	7	8		
10	10	W	64 8	55·3	50·6	45·1	46·7	40·3	49·6	46·6	49·9	63 2	
		H	243	241	231	237	239	229	238	246	241	244	
		S	8	8	7	6	6	5	6	6	7	9	
11	11	W	73·	53 9	43 8	39 7	46·7	42·3	46·9	42·9	58·8	45·5	75·1
		H	238	237	229	223	231	232	232	223	225	231	235
		S	10	6	6	5	7	6	6	6	7	7	10

W-weight of grain in gms., H-height of plant in cms. and S-weight of straw in lbs.

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Tea Cultivation in South India.

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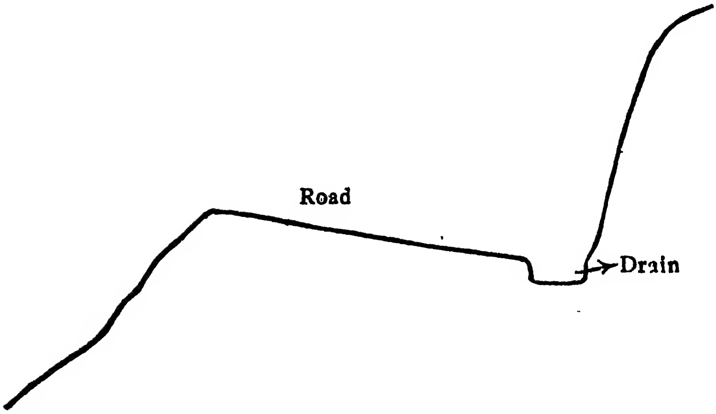
(*Continued from page 91.*)

NEW CLEARINGS

Felling. After the planter has surveyed the area he intends planting, and clearly marked the boundries, the fellers start their work of felling the trees and cutting down the dense undergrowth. This work is done at the beginning of the dry weather i. e. about December and January. In the writer's experience, quite the best people to employ on it are Moplahs. It is a dangerous work except in the hands of experts who know exactly in which direction the tree they are felling will fall, as many of the huge trees are well over 100 feet high and several feet thick at their bases. A couple of months of dry weather is enough for the undergrowth, small trees and bushes, and foliage of the big trees to dry out sufficiently to burn off the clearing. This is done just before the first rains, and a day is chosen when there is not much wind and when what wind there is blowing in the right direction i. e. not towards a neighbour's tea fields. All boundaries adjacent to tea fields must be cleared of branches and undergrowth for twenty yards or more, and neighbours must be warned for miles around, as there is great danger from flying sparks carried by the wind starting fires if they alight on rotten logs or tree stumps.

Burning. On the clearing to be burnt off the smaller dried undergrowth is collected into regular heaps, and the igniting coolies then start through in line from one end. If the 'burn off' is a good one it will last for two days or more and there will be little or no 'clearing' to be done afterwards. If early showers or some such reason causes the burn off to be a poor one it will finish in a day, and there will be a lot of expensive clearing, collecting and burning to be done after-wards before it is possible to line the clearing. In any case the big logs are just singed on the outside and remain lying about until they are sawn and chopped up into fuel for the factory tea driers in later years. If by misfortune a strong wind springs up during the burn off and carries fire to neighbouring estates, the planter who started the fire is responsible for any damage done.

Laying roads. When the ashes have cooled down sufficiently, roads are traced and lining started. In connection with the former there are a number of elementary commonsense rules to be observed, e. g. roads should only cross at ravines, and a down trace may only change to an up trace at a ravine. This is all connected with water drainage. Then there is the general plan of the rest of the estate to take into account, and where the roads are wanted to lead to. The ordinary estate footpaths are cut 4 or 5 feet wide and should slope inwards to a small road drain as in the accompanying sectional view.



Water meeting a blockage of fallen earth or rubbish will flow a course round it and back into the drain on the other side instead of across the road and down the hillside so scouring away valuable top soil. As a general rule the steeper the hill-side the road is on, the steeper the roads will have to be to cover all the ground for supervision purposes. In tracing a cart road where the main object is to get from one place to another in as short a distance as possible double cuttings through the tops of ridges and embankments across ravines will save distance and cut out many sharp corners which cost a lot in later upkeep. For cart roads gradients should not exceed 1 in 12, but car roads can be traced a lot steeper to save distance. Big deep drains are unnecessary and dangerous to traffic, but as many culverts as possible should be put in to carry off rain water i. e. wherever the road crosses a ravine or hollow. No culvert should be less than 1½ feet square so as to allow for clearing out whereas many must of course be much larger according to the amount of water they may have to cope with. This all sounds elementary but it is surprising to see the damage caused in the heavy rains through these simple rules being ignored. The roughly opened clearing and the cheaply made road are very definitely cases of 'penny wise and pound foolish' policy.

Planting. Tea is usually planted 4' by 4' or 4½' × 3½, which means about 2700 bushes per acre. It is usual to line the rows north and south as the shade from the rows of shade trees usually silver oaks-Grvillea robusta which will be distributed more evenly as 'the sun moves over.' When marking out the lines the direction is of course taken by the compass, and on steep slopes the distances must be plumped, otherwise the lines will become anything but straight. As later on all task work is given by the rows and pluckers pluck also by rows it is very necessary to have them straight and continuous. After the 'king pegs' i. e. the pegs marking the rows have been put in, smaller pegs are put in down the rows to mark the spot where each bush is to be planted. This is done by stretching a long rope between the 'king pegs' which has cloth tags attached at the required intervals. Holes are then dug with crow-bars (*alavangoes*) 1½' deep and

6" wide at the bottom and these are filled with top soil well pressed down, and the centre of the spot marked with a stick. The clearing is now ready for planting up, which will start as soon as continuous rain is assured.

Methods of planting. Plants used may be (a) six month old basket plants, (b) six month old jungle nursery plants transplanted, or (c) 18 month old jungle plants. There is a fourth method of planting out which hardly merits mention and that is seed at stake This is an expedient adopted by the lazy or improvident, who have not troubled themselves to lay out nurseries, and who simply plant the seed out directly in the clearing marking the spot with a stake. The same planter would probably not trouble to have holes dug. If his 'burn off' has been a severe one with resultant loss of humus he is not likely to have much success.

(a) *Six month old baskets.* In planting these out great care must be taken not to shake and lessen the earth in the baskets during transport to the field.

(b) *Six month old jungle nursery plants.* As each plant is removed from the nursery bed with the aid of a 'transplanter' it is carefully shifted from the transplanter into a tin cylinder for transport to the field. The chances of the earth loosening and some falling during transport are so great that this method is not much used.

(c) *Eighteen month old stump plants.* The 18 month old plants which are about 6 or 7 feet high are carefully dug up, the stems cut square across about 3 or 4 inches above the hypocotyls. The main tap root ends are cut off at about 16" below the hypocotyl and all side roots and 'whiskers' trimmed off. The stumps are then planted out with crow-bars, care being taken to plant at exactly the right depth and to plant firmly. Of the two chief methods of planting some planters prefer "baskets" and some prefer "stumps". Possibly stumps give best results in new clearings, and baskets give better results as 'supplies' for the vacancies in old clearings. After planting, the plants are protected by a ring of stakes or wooden slats or pieces of bark driven into the soil. It is also well worth while to pile a large heap of weeds or jungle growth round about the plant at the beginning of the next dry weather, so keeping the surrounding soil moist and cool throughout the dry weather. Vacancies should be supplied up in the years immediately following planting.

(To be continued)

A Preliminary Investigation on the Efficiency of some Fodders for Milk Production.

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Introduction. In India, cattle are kept on the farm principally for work and as producers of butter fat or milk. Their usefulness to the stock-owner is greatly enhanced by judicious feeding. It is well known that the feed of dairy cows includes a maintenance ration to keep them going with a constant body weight and also a production ration depending upon the quality and quantity of milk yield. After supplying as much of the nutrients as possible in the form of roughage to keep the animal " comfortably full ", the remaining ingredients have to be sought for and supplied in the form of 'concentrates'. Feeds and fodders thus together constitute the dairy cow's bill of fare. Though only what is grown on the farm is usually fed to cattle, it is preferable to include in the ration a variety of cattle foods. The Agricultural College Dairy at Coimbatore, adopts the accompanying schedule ration:—

TABLE I. Schedule of rations for dairy herd at Coimbatore 1934—35.

Class	Yield in lbs.	Ground nut cake lbs.	Cotton seeds lbs.	Rice bran lbs.	Dhal husk lbs.	Common salt oz.	Mineral mixture oz.
A	25—30	3	3	2	3	2	2
B	20—25	2½	2½	2	2½	2	2
C	15—20	2	2	2	2	2	2
D	10—15	1½	1½	2	1½	2	2
E	5--10	1½	1	1	1½	2	2
Price per lb in pies.		5·31	5 57	5·50	5·28	5·49	10·00

The ration provides 2 lb. of concentrates for maintenance and an additional 3 lb. of concentrates for every 10 lb. of milk produced. The importance of salt and mineral mixture for the young stock and the lactating cow is too well known. Green succulent fodder is indispensable to milch cows. The palatability of green fodders and their slightly laxative effect make the cow better fitted for her performance. Even if it contains less of nutrients, palatability, it is said, should be an important consideration in the choice of food stuffs. Succulent fodders whet the appetite of the animals with the result that larger amount of roughage is consumed.

It is the desire of the average ryot to substitute as much of the concentrates as possible by roughage and thus bring the cost of milk production down to the minimum without loss of efficiency. It is here that the research worker should tell him what fodder and how much of it should be given to his stock to obtain the maximum benefit.

The growing of crops entirely for the use of the farm stock is not widely practised in India unless it be in Government farms and their necessarily 'infectious' surroundings. What poor little stuff remains in the form of herbage stalk or straw is fed to the animals, and no wonder that the cattle

do not perform their work with efficiency. Many cultivators in this country have yet to realise the immediate necessity for setting apart a portion of their holding for raising fodder crops for their stock.

Among the various crops that are selected as fodders, the cereals and the legumes figure prominently; sorghum (cholam or Jonna) and Indian corn (maize) belong to the former group, while cow-pea and *pillipesara* are leguminous plants. These crops are grown individually or as mixtures as evidenced by the well known sorghum cowpea combination. Mention may be made in this connection of two exotic crops, whose value in the economic feeding of farm stock is being increasingly appreciated. The Guinea grass (*Panicum maximum)* and lucerne (*Medicago sativa)* are now grown in several parts of Madras.

The following table gives the average yields and the cost of cultivation per acre of the three main fodders in the Central Farm, Coimbatore.

TABLE II Cost of Production of fodders—average of nine years from 1925—34.

Fodder	yield per acre in lbs.	cost of cultivation			lbs. per rupee	cost of produciion per lb in pies.
Cholam	18,024	48	13	11	369	0·52
Maize	14 518	56	6	9	257	0 74
Guinea Grass	31,737	45	8	3	697	0·27

Nature of the Investigation. Investigation was started under the auspices of the Madras University in October 1935 to study the effect of some of the fodders with the existing kinds of concentrates on the milk yields of cows at the Agricultural College dairy, Coimbatore. Three different fodders were selected and fed in weighed quantities to the cows continuously for a number of days and from their milk yields it was possible to determine how much feed of each fodder was required to produce one lb. of milk. The possibility of curtailing the quantities of concentrates as a measure of economy by reducing the normal production ration from 3 lbs. of concentrates for every 10 lbs. of milk to 2 lbs. for the same quantity was also investigated.

The reduction of concentrates was made without seriously affecting the nutritive ratio by a careful adjustment of the different kinds of concentrates. The following represents the reduced ration chart:—

TABLE III. Reduced ration chart.

Concentrates	Class A	Class B	Class C	Class D	Class E
Groundnut cake	2½	2½	2	1½	1½
Cotton seed	2½	2	1½	1½	1
Rice bran	1½	1½	1½	1	1
Dholl husk	1½	1	1	1	½
Total in lbs.	8	7	6	5	4

In addition, 2 oz. of salt and 2 oz. of mineral mixture were also supplied in each of the rations. (Mineral mixture is made by intimately mixing equal parts of shell meal and steamed bone meal.)

Limitations of the Experiment. The investigation conducted had to be discontinued after a short period. The nature of the experiment is such that it requires longer periods to come to any conclusion and should be conducted on a larger number of animals. Dealing with biological systems, the experimenter on livestock is confronted with considerable difficulty. The trouble begins from the selection of animals which are to be similar in age and condition, yield and lactation, breed and body weight. The continuous supply of fodders and their composition depend largely upon the vagaries of the season and the age of the crop respectively. Ill health and disease of the experimentals will certainly vitiate the results of the experiment. Moreover as the experiment was conducted on cross bred cows, it cannot be said with much certainty what would be the effect of these fodders on the indigenous type of animals.

Experimental details. Six cross-bred cows fairly similar in age, yield and lactation were selected for the experiment. Although five cows were in their fifth lactation one was in its second. They were divided into three lots of two cows each. Three green fodders were selected :—

1. Fodder maize
2. Fodder Cholam

and 3. Guinea grass.

These were fed as much as each animal would eat. And the quantities were fixed by a week's feeding trial prior to the actual expriment at 55 lbs. for Guinea grass and fodder cholam, and 60 lbs for fodder maize, which included some quantity left as residue. Each treatment in each lot lasted for 31 days of which the first 10 days were considered as pre-treatment periods to allow the animals to get accustomed to the changed ration and the next 21 days alone being counted as experimental period. A summary of different treatments is given below.

TABLE IV. Treatments.

Lot	Cow No.	October.	November.	December.
1	258 & 319	Guinea grass and full concentrates	Guinea grass and full concentrates	Guinea grass and full concentrates
2	250 & 265	Guinea grass and reduced concentrates	Fodder maize and full concentrates	Fodder maize and reduced concentrates
3	263 & 252	Fodder cholam and full concentrates	Fodder maize and reduced concentrates	Fodder maize and full concentrates

Lot 1 received guinea grass and full concentrates during the three months, which were treated as 'controls'. The treatment viz., fodder cholam and reduced concentrates could not be continued in November or December as by then the whole crop had been off the field. In November and December the "reversal" method was adopted between lot 2 and 3. The concentrates were altered and fed according to the milk yield once in every fifteen days.

Discussion of Results. Three lots of animals were put on different fodders and different quantities of concentrates. From the exact quantities of fodder and the concentrates consumed by the different lots during each of the three months of experimentation and the quantities of milk yielded by three lots in the corresponding periods, the quantities of fodder, utilised in the production of one pound of milk were calculated. The cost of fodder and the cost of concentrates per pound of milk were also worked out.

TABLE V. Treatments and yield.

Lot	October. Fodder consumed lbs.	October. Milk yield lbs.	October. Cost of conc. in pies.	November. Fodder consumed lbs.	November. Milk yield lbs.	November. Cost of conc. in pies.	December. Fodder consumed lbs.	December. Milk yield lbs.	December. Cost of conc. in pies.
1	2173	$1139\frac{1}{4}$	2198·20	2226	$1092\frac{1}{2}$	2327·48	2216	$1038\frac{1}{4}$	2157·50
2	2215	$864\frac{1}{2}$	1364·18	2243	$872\frac{1}{4}$	1988·12	2465	$663\frac{1}{2}$	1255·53
3	2166	$873\frac{3}{4}$	1899·24	2480	$784\frac{1}{2}$	1369·77	2454	$688\frac{1}{2}$	1648·76

Lot.	October. Treatment	October. Cost of fodder pies.	October. Cost of conc. pies.	November Treatment	November Cost of fodder pies.	November Cost of conc pies.	December Treatment	December Cost of fodder pies.	December Cost of conc. pies.
1.	G. Grass & full conc.	0 51	1·928	G. grass & full conc.	0·55	2·143	G. grass & full conc.	0·58	2·048
2.	G. grass & reduced conc.	0·69	1·578	Fodder maize & full conc.	2·06	2·280	Maize & reduced conc.	2·77	1·905
3.	Cholam	1·29	2 170	Maize & reduced conc.	2·35	1·745	Maize & full conc.	2·65	2·413

In 93 days, we have the data from three sets of experiments each of 21 days' duration the first ten days being considered pretreatment period. Though in fact nine treatments were carried out in three lots of animals in three in instalments, there are only five different treatments, others being only repetitions. The following table represents the 5 different treatments, the average quantities of fodder used up in production, their cost and the cost of production of one pound of milk.

TABLE VI. Treatments and cost.

Treatment	No. of repeti-tion	Quantity of fodder per lb. of milk.	Cost of fodder per lb. of milk in pies.	Cost of conc. per lb. of milk in pies.	Cost of production of a lb. of milk	percentage cost of fodder.
G. gr. & full conc.	3	2·02	0·553	2·048	2·601	21 3
G. gr. & reduced conc.	1	2 56	0·701	1·578	2·279	30 8
F. ch. & full conc.	1	2·48	1·289	2·170	3 459	37·3
F. Mze. & full conc.	2	3·18	2·365	2·346	4·711	50·2
F. Mze. & reduced conc	2	3·45	2 566	1·825	4·391	58·4

Taking Guinea grass as the standard of comparison, and 100% efficient the fodders and their treatments can be rearranged according to their efficiencies in the following order.

TABLE VII. Treatments and their efficiency.

Treatment	Quantity of fodder per lb. of milk.	Efficiency of fodder.
G. grass & full conc.	2·02	100
F. cholam & full conc.	2·48	81
G. grass & reduced conc.	2·56	79
F. maize & full conc.	3·18	64
F. maize & reduced conc.	3·45	59

It is by no means presumed that these different fodders are capable of their performance individually, but can be said to do so only in conjunction with the particular kind of concentrates. The above table reveals that though there is a corresponding decrease in the cost of concentrates per lb. of milk, when the concentrates are reduced in the production ration by a third of its normal ration, the quantity of fodder used up per lb. in production of one pound of milk increased slightly, but not to such an extent as to make the reduction of concentrates on the whole uneconomical as evidenced by the cost of production of a pound of milk. In the following table, the savings in the cost of concentrates by reducing the normal ration to two thirds of that followed in the dairy, has been worked out:—

TABLE VIII. Saving in cost.

Class	cost of concentrates in pies (normal ratio)	Cost of concentrates in pies (reduced ratio)	Saving in the cost of concentrates in by difference	Percentage saving in cost
A	55·416	40·806	14·610	26·4
B	47·336	35·381	11·955	25·3
C	39·256	29·941	9·315	23·9
D	31·176	26·036	5·140	16·5
E	25·891	20·611	5·280	20·4

The milk yield and the live weights of the experimentals have formed the basis of the inference. It has been noticed that there was a gradual fall both in milk production and the weight of the cows.

Average weekly live weights of the cows.

TABLE IX.

	October.				November.				December.			
Cow No.	1st week	2nd week	3rd week	4th week	1st week	2nd week	3rd week	4th week	1st week	2nd week	3rd week	4th week
258	1020	996	981	984	968	968	972	981	971	980	972	1000
319	1064	980	996	992	984	960	978	965	976	992	1012	1056
250	932	904	884	844	844	864	817	850	861	872	856	868
265	836	824	778	748	748	776	701	721	739	776	764	784
263	1020	1064	1032	992	1036	980	1044	1049	1016	1028	1032	1040
252	1036	1049	1013	1000	960	948	972	992	980	972	992	1100

But as this was found to happen in all and not confined to one particular lot or treatment, it is not reasonable to say anything against any particular fodder or treatment including the reduction of concentrates. It is quite possible that the lactations and the seasons had their share in lowering the milk yield and weights of the animals. However investigations of this sort can be precise only if continued for longer time and over larger number of cows in many lactations.

Summary. Six cross bred cows were experimented upon to study the effect of three fodders grown at the Central Farm Coimbatore, on the milk yield of cows at the Agricultural college dairy. They were divided into three lots, each lot being given varying treatments of fodder and concentrates. The following indications are observed:—

A. Basing on the quantities of fodders used up by cows for milk production the three fodders studied may be arranged in the decending order of their efficiency as guinea grass, fodder cholam and fodder maize.

B. when the concentrates are reduced from the full ration a slight increase occurs in the quantity of fodder consumed but the cost of this increase is negligible when compared to the saving effected by decreasing the concentrates.

C. A reduction of a third of the quantity of concentrates in the production ration of the cows is possible, justifiable and economical.

Acknowledgement. The author's grateful thanks are due to R. C. Broadfoot Esq, Principal, Agricultural College, Coimbatore for granting permission to work in the college dairy and to Sri K. Raghavachariar, Lecturer in Agriculture for guiding the work with timely suggestions.

Sri V. Karunakaran Nair and M. Alagiriswami, the Dairy managers, had been of great help to me and their help is gratefully acknowledged.

The Hairy Caterpillar Pests of S. India.

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Among insect pests of economic importance all over the world the creatures known as hairy caterpillars not only possess a very high degree of importance, but are also very well known to all cultivators. Such forms as the gipsy moth, the tussock moths, the web worm, tent caterpillars, brown tail moths, tiger moths etc., are some of the notorious members of this category of insects in different parts of Europe and America. Of the many species of hairy caterpillars found in South India and known under different local names such as *Kambli poochi* (tamil), *Kambli puzhu* (malayalam), *Gongali purugu* (telegu), *Kambli hula* (kanarese), etc., we have about two dozen forms possessing different degrees of economic importance and attacking a variety of cultivated plants. A brief account of the general features, economic importance and possible methods of control, is given below.

General Organisation and Bionomics. These caterpillars are larval forms of different kinds of moths. They are more or less cylindrical creatures worm-like and clothed with hairs. In length they range from an inch in the smaller species to three or four inches in the case of giants among them; they are usually elongated and more or less of uniform build from head to tail except at the thoracic region in some, and in many cases depressed along the median dorsal region. In most of them the head is hemispherical and the thoracic legs and the ten abdominal pro-legs are generally distinct.

The clothing of hair varies a great deal. In some the covering is sparse as in the *Syntomidae*, in others the body is closely covered often with the hairs long or short and closely arranged in tufts rising from fleshy tubercles and in-transverse rows on the body as in *Arctiidae* and *Eupterotidae.*, and in some others the hairs on some regions of the body, especially the head and throax, are differentiated into long tufts, elearly marked off from the hairs of the other regions as in *tussock worms* (Lymantridae) or arranged in closely packed brushlike pattern often in different cryptic colors as in *Lasiocampid* larvae. The hairy clothing in some of these forms is often found mixed up with sharp setae and poisonous nettling hairs very irritating to the touch. This hairy protection arranged in different patterns is evidently helpful in keeping away many a bird or reptile enemy. Though there are a few individual variations in some forms, all these caterpillars behave more or less in the same manner and their life history and habits are similar in many respects. They are mostly surface forms and feed exposed without any special protective contrivances as is generally found in many leaf rolling, shoot folding or boring caterpillars, though a few like the sunn hemp caterpillar thrust their heads into seed pods. Some of them, especially the *Eupterotids* as in the case of the moringa caterpillar feed gregariously in hundreds together so that the plant surface becomes uniformly covered with a blanket-like woolly covering of live caterpillars. These caterpillars also possess the usual habit, like most moth larvae, of hanging themselves on silk strands and getting widely distributed on the food plant. They move about actively and some of them temporarily curl up when disturbed, like millepedes. In the case of some like the notorious red hairy caterpillar of groundnut (*Amsacta albistriga*) swarms of them regularly march from field to field like locusts or army worms, regardless of the dangers and impediments, feeding on almost everything green and leaving behind them a trail of defoliated or skeletonised plants. We find these plagues occasionally blocking foot paths and public roads near fields. Some years ago a swarm of these actually stopped and delayed a railway train in the S. Arcot district ; they marched along the track in enormous numbers and covered the railway road for a fairly good distance ; their crushed bodies made the rails so slippery that the engine could not get traction, with the result that the train had to stop and was able to proceed only after the rails were completely cleared of these creatures. Some of these creatures can become a domestic nuisance in some areas ; the red hairy caterpillar plague often enters huts and dwellings in the proximity of groundnut fields and causes disturbance and affects children who often come into contact with them unknowingly. In the submontane tracts along the Western ghats the lichen and moss feeding dark brown hairy form (*Asura conferta*) invades houses and becomes a regular nuisance in various ways during the post-monsoon months (August-November). The nature of the irritation and discomfort casued to our bodies by coming into contact with them vary with different species and with the varying constitution of the persons affected ; in some persons the touch of the moringa

caterpillar (*Eupterote*) or the Wooly bear of ragi (*Amsacta lactinea*) or the Babul lasiocampid (*Metanastria*) causes not only wide spread irritation but also gives rise to eruptions on the body as in the case of nettling and poisonous plants.

Life history. There is nothing very peculiar or striking in the life histories of these creatures, and very few variations are found. Each moth lays a number of eggs ranging from 20 or 30 to as many as a thousand and these are generally deposited in massess or clusters, each mass being covered over by a felted hairy covering. The young ones hatching out of these eggs move about often in company and feed on the green matter of their respective food plants. As they grow and moult they separate and when full fed pupate. Pupation is either on the plant itself or in some cases in the soil; in the former case the pupa is found enclosed in a hairy cocoon made of silk and frass and in the latter case the creature goes two or more inches below the soil and pupates inside an oval earthen coccon. The incubation period of the pupa varies in different species; some of them, especially the notorious red hairy caterpillar (*Amsacta albistriga*) remains underground in the pupa stage from September or October to the following June or July. Thus the number of generations per year would vary, since the pupation period varies from a fortnight or two in some to eight or nine months in others. The adults of hairy caterpillars are moths of varying colors and sizes; some are small and sombre while others have expansive wings and display varying colors, often with spots, or patches in attractive tints. Many moths exhibit an attraction to lights (Phototropism) and hundreds are often found hovering about street lights and household lamps. The moth of the domestic hairy caterpillar (*Asura*) noted above displays this tropism in a pronounced degree. Though the adult moths are winged in most species, some forms of female moths are wingless, e. g. the castor tussock (*Orgyia postica*). The female in such cases appears as a mass of flesh with legs and rarely moves from the place of emergence. The life of the adults is as usual short and mating of the sexes takes place within a day or two; soon after mating or egglaying the parents die.

Economic importance. While some are extremely important as serious crop pests others are either of minor importance or only occur occasionally as sporadic local plagues. There are very few commonly cultivated plants which escape the attentions of one or more of these hairy creatures. The tabular statement below gives briefly the name, group, food plants, status and other information worthy of note of the forms so far noted from S. India, which are associated with cultivated plants. However, a few words on some of the important species among them call for some special attention on the part of agriculturists. The most important of these economic forms in S. India is the Red hairy caterpillar (*Amsacta albistriga*, M.). While it is almost omnivorous in food habits it exhibits a special liking to dry crops like groundnut, *cumbu*, sorghum and pulses. The wide spread extension of groundnut cultivation throughout the presidency within the past decade or two has helped this insect to distribute itself widely in the different tracts

of the province; until a few years ago it was a pest only in parts of the coromandal coast districts of S. Arcot, Chingleput etc.; but now we have it in the N. Circars, Mysore and Ceded districts, not to speak of its activities in the southern areas of Madura, Tinnevelly and Ramnad districts. This insect is found specially partial to red soil areas but so far it has not attracted the attention of the cultivator along the West coast tracts. Between this pest and most of the other members of this hairy group of the plains there is a very wide gulf, since not one of the latter has approached it either in its wide distribution or in the extent of damage caused, and we have had hardly any report of a very serious nature about any of the other species of this group. The tussock caterpillars of Castor, Gogu, Paddy, Mango, etc. spp. *Euproctis, Psalis* etc. and the wooly bear caterpil'ar of ragi, pulses etc. (*Amsacta lactinia*) may be ranked next; the wooly bear is generally found on ragi, pulses etc. but is not a regular pest like the red hairy caterpillar. It is recorded as a serious pest in Gujarat. The castor plant often suffers badly from species of *Euproctis* and *Orgyia.* The hairy caterpillars on the sunn hemp plant (spp. of *Utetheisa* and *Argina*) also become occasionally serious in parts of the Northern Circars and the Southern districts of Ramnad and Tinnevelly. Castor and Banana suffer sometimes badly from sporadic attacks of the dark brown hairy caterpillar (*Pericallia ricini*). The yellow and dark hairy caterpillar (*Diacrisia obliqua*) which is a well known pest in N. India and called the Behar hairy caterpillar by authors, though found in S. India, is not so destructive or widely distributed. It is generally noted in the submontane areas along the west coast and is chiefly a feeder on wild plants, like lantana, mimosa etc., though occasionally noted also on sweet potato and wild convolvulaceae in Malabar. The blanket caterpillar (*Eupterote mollifera*) is a well distributed creature and is found on the moringa tree all over the province often found covering the main stems and branches in hundreds. The zyzyphus hairy larva (*Thiacidas postica*) with its pale brown body covered with long pale whitish hairs has also this gregarious habit and is well distributed in the dry districts. The occasional sight of the complete skeletonising of large ficus trees (Banyan, Peepul etc.) along some of our roadside avenues and meadows is caused by the grey red headed ficus hairy caterpillar (*Hypsa ficus*); similarly the Ailanthus tree is also found completely defoliated often by the hairy caterpillar (*Eligma narcissus*) in parts of Coimbatore and Salem districts. Within the past two or three years I have also come to know of serious outbreaks of a hairy caterpillar pest in the Cardamom plantations along the Western ghats, especially in parts of Coorg. So far as I could make out the insect appears to be allied to the moringa caterpillar and is probably a species of Eupterote (*E. Canaraica*, M.) previously noted from the ghat regions of Mysore.

Control. Methods of control against hairy caterpillars attacking cultivated crops depend mainly on the life habits of each species concerned, the extent and nature of the damage caused by it and the local conditions. Some minor pests like the Paddy hairy caterpillar (*Psalis securis*), the sweet potato syntomid (*Euchromia polymena L.*) or the ficus tussock (*Perina*

nuda F.) etc. do not generally demand any serious attention. Advantage should be taken of such habits as egg laying in masses, gregarious feeding, pupating underground or in masses on the food plant, attraction to lights, or special traps etc.—so that the pest can be checked effectively and economically by tackling them at such stages. Handpicking and destruction of the first emerging moths and egg clusters, collection and destruction of gregariously feeding larvae, trapping of phototropic moths by means of light traps, ploughing up the soil of a badly infested field to destroy the underground pupae to check future generation—all these are methods which will prove effective and very practicable. When such feasible methods are not adopted at the proper time and the pest allowed to increase and the caterpillars become a plague it will be found very difficult, expensive and even impossible in some cases to check them. Of course to resort to these timely and suitable measures the cultivator has to get some acquaintance with the main points in the life history and habits of these pests in his tract; it is evident from this how important and helpful it will be for every cultivator to get some general knowledge of his crop pests. In the case of the Red hairy caterpillar the following were the chief instructions given to cultivators in badly infested areas and these might be followed in all such cases. (1) During the three or four days after each good shower in May—June even little boys may be employed to hand pick the moths which appear late in the evenings in the fields that were badly infested the previous season. Each boy will be able to collect hundreds and these can be killed easily by crushing or burying them deep. The moths are very inactive at this time. (2) Keep light traps at dusk. These lights will attract numbers of moths and they can also be killed easily. The destruction of one moth is equal to the destruction of 800 or 1000 caterpillars and so this is the best method of control for the pest. Those fields that were badly infested the previous season may also be ploughed in summer to bring up the underground pupae. In some fields they might be found in heaps of thousands and in one or two cases several bushels of these date seed like pupae were collected. These can be crushed or exposed when birds destroy them quickly. Spraying, dusting, or trapping with chemicals, though effective may not be found practicable propositions in this country at present, not only from the point of view of economy, but also from the point of view of risks attending the use of poisons. In India insecticides and spraying machines can only be suggested for ordinary field crops when cheap local insecticides and applicances become easily available and when the standard of literacy of our average farmer improves. In the case of serious plagues of these caterpillars when they often move from field to field in swarms the progress of the moving hordes can be checked by digging trenches and entrapping them and isolating the uninfested area. The frequent attacks of the red hairy caterpillar in parts of S. India during the past decades had become so serious that government had to resort to legislative measures in connection with this pest, and a pest act is enforced during certain months of the year (generally from June to October) in

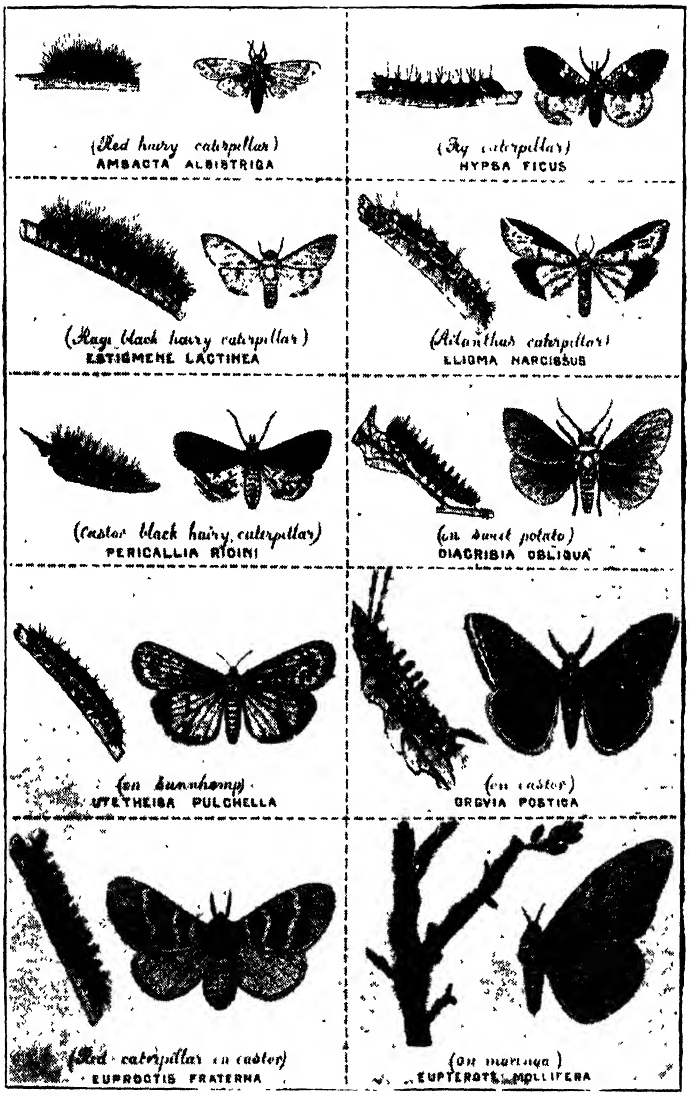
notoriously infested areas, and cultivators are compelled to carry out certain stipulated measures chiefly those noted above, to control the pest. No other caterpillar has become such a serious pest in S. India till now.

Though some of these caterpillars are subject to the attacks of hymenopterous and tachinid parasites and sometimes to bacterial diseases, we have not as yet secured sufficient data or material as regards their natural enemies and their possibilities for utilising them in the biological control of these pests.

*** Some South Indian Hairy Caterpillars of Economic Importance.**

Popular and Scientific Name.	General form of moth and caterpillar.	Chief food plant.	Remarks.
Family Arctiidae			
Red hairy caterpillar *Amsacta albistriga*, W.	Moth with whitish brown wings and the abdomen with red bands. Caterpillar brown to reddish with dark markings.	Ground-nut, millets, pulses.	The most serious of all the South Indian forms (pupates under-ground).
The black wooly bear *Estigmene lactinea*, H.	Moth beautifully white with pink and dark markings. Caterpillars black and profusely hairy moving like a bear.	Millets and pulses.	Not a regular pest though serious when sporadic.
Black castor hairy caterpillar *Pericallia ricini*, F.	Moth—upper wings greyish brown, lower wings reddish with dark patches. Caterpillar dark grey well covered with hairs.	Castor, banana and pulses.	Sometimes bad on castor and garden crops.
Sunn hemp hairy caterpillar *Utetheisa pulchella*, L.	Moth—upper wings spotted with red and black, lower wings pale white with dark patches along margin. Caterpillar dark with red and white markings.	Sann hemp.	Often serious on sunn hemp; moth flies during the day.
Behar hairy caterpillar *Diacrisia obliqua*, W.	Wings pale yellowish with isolated dark spots, abdomen orange and spotted Caterpillar stout pale brown with yellowish cross bands and profusely hairy.	Sweet potato Lantana.	A serious pest on various crops in parts of North India
The household hairy caterpillar *Asura conferta*, W.	Small orange coloured moth with dark patches on forewings and along margin of hind wings. Caterpillar small dark with orange spots and very hairy.	Feeds on lichen, moss etc., on walls of houses, tiles etc, is a domestic pest.	Often a nuisance in houses in villages near ghats during the rains.
Small cholam ear-head hairy larva *Celama internella*, W.	Small pale white moth. Small greyish caterpillar.	On cholam ears and mango leaves.	Of minor importance.

*** There are also found a few caterpillars which are more or less hairy among Microlepidoptera and other moth families but only the more conspicuous of these having any economic importance are included here.**



Some South Indian Hairy Caterpillars.

Popular and Scientific Name.	General form of moth and caterpillar.	Chief food plant.	Remarks.
Family Lymantriidae			
Red Tussock caterpillar *Euproctis fraterna*, M.	Yellow winged moth. Caterpillar dark brownish red with tussock hairs on head.	Castor, red gram, cotton, rose	Sometimes sporadic on castor, cotton etc.
Yellow striped tussock caterpillar *Euproctis scintillans*, E.	Moth like *E. fraterna* but the wings with bigger pale patches. Caterpillar similar to *E. fraterna* but with a longitudinal dorsal yellow stripe.	Mango, gogu etc.	Rarely serious.
Castor tussock *Orgyia postica*, W.	Female wingless, male small dark brown moth. Caterpillar brownish with tussock hairs.	Castor.	Often serious on castor, pupates on the plant.
Babul Tussock *Euproctis lunata*, W.	A small yellowish white moth. Small greyish caterpillar.	Acacia arabica (Babul)	Sometimes very bad on the babul tree.
Paddy yellow hairy caterpillar *Psalis securis*, Hb.	Pale grass yellow moth forewings yellowish. Caterpillar with red and dark markings and long tufts of hairs.	Paddy, grasses.	Very rarely serious.
Fig Tussock caterpillar *Perina nuda*, F.	Male forewing hyaline, female pale yellowish. Greyish green larva with tufts of hair on all sides.	*Ficus* spp., Jak.	A minor pest.
Zyzyphus hairy caterpillar *Thiacidas postica*, W.	Upper wings greyish lower ones pale white. Pale greyish larvae with close covering of long hairs.	Ber (Zyzyphus jujuba).	Sometimes found in hundreds on the food plant.
Tea hairy caterpillar *Dasychira horsefieldi*, S.	Grey coloured moth. Grey larvae.	Tea.	Sometimes sporadic in tea areas.
Tea and Castor tussock *Olene mendosa*, H.	Brownish moth. Caterpillar is like that of *D. horsefieldi*, S.	Castor, red gram.	Do.
Family Hypsidae			
Ficus hairy caterpillar *Hypsa ficus*, F.	Pale yellowish moth with yellow and black markings at base of forewing. Caterpillar dark brown with white, yellow and reddish markings.	*Ficus* spp.	Sometimes very serious on Ficus trees.
Sunn hemp hairy caterpillar of orange moth *Argina cribraria*, C.	Wings orange coloured and with dark spots. Caterpillar like that of *Utetheisa pulchella*.	Sunn hemp.	Occasionally bad.
Sunn hemp caterpillar of crimson moth *Agrina syringa*, C.	Caterpillar like that of *Utetheisa pulchella*.	Do.	Do.
Family Lasiocampidae			
Babul hairy caterpillar *Metanastria hyrtaca*, C.	A large grey brown moth with shady patches on wings Long grey larva fully covered with poisonous hairs.	Babul, Parijath (Nyctanthes).	Rarely serious.

Popular and Scientific Name.	General form of moth and catterpillar.	Chief food plant.	Remarks.
Family Eupterotidae			
Moringa hairy caterpillar *Eupterote mollifera*, W.	Large pale yellowish moth Long greyish caterpillar with irritating hairs.	Moringa.	Often found on this tree in thousands
Paddy Eupterotid *Nisaga simplex*, W.	Brownish yellow with dark markings on wings. Blackish caterpillar with yellow markings.	Paddy.	Found occasionally in some numbers in Ganjam district.
Cardamom hairy caterpillar *Eupterote canaraica*, M.	A reddish brown moth. Pale brown hairy caterpillar.	Cardamom.	Found in thousands on cardamom and other low growing crops chiefly in Coorg and parts of the western ghats.
Family Saturniidae			
The wild silkworm *Cricula trifenestrata*, H.	Large pale brown moth with eye like spots on all wings. Dark brown caterpillar covered with tufts of nairs which are poisonous and irritating.	Cashew and mango.	Cocoon of hairs and silk, golden yellow and found in masses on the tree; the caterpillars feed together in numbers.
Family Syntomidae			
The sweet potato syntomid *Euchromia polymena*, L.	Dark moth with orange spots on wings and red bands on abdomen. Caterpillar not very hairy.	Sweet potato.	Sometimes serious on sweet potato in Travancore.
Family Noctuidae			
Ailanthus hairy caterpillar *Bligma narcissus*, C.	A large beautiful moth yellowish with pale and dark stripes on wing. Long larva with red and black bands and yellowish head and covered with slender hairs.	*Ailanthus excelsa* an ornamental tree in Coimbatore area.	Found often in numbers on the tree. Pupa also on tree stem inside a pale silken cocoon.
Bringal leaf folder. *Eublemma olivacea*, W.	Olive green in colour with hind wings alone pale whitish. Medium sized caterpillar violet brown with yellow spots and hairy.	Brinjal.	Sometimes bad on brinjal as a leaf folding pest.
Brinjal hairy caterpillar. *Cryptothrips occulta*, S.	A small grey brown moth Small caterpillar very hairy and with long yellow streak along dorsal side.	Brinjal.	Often very bad on brinjal foliage, especially in Malabar. Feeds gregariously

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SELECTED ARTICLE

The Collective Farm System in Russia.

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The story of co-operation in Russia has been different, both in its history and in the final form which it has now reached, from anything that has happened, in any other country in the world. It began about the end of the last century on lines similar to those in other countries and although it was distrusted by the Government of Imperial Russia, yet it developed very rapidly. Before the great world war the Co-operative societies numbered at least 27,000 chiefly for the supply of agricultural credit. The Communist Revolution in 1917, destroyed almost the whole of the previous structure, specially so far as credit societies were concerned and what was left became for the time being practically a State Department.

A reaction took place in 1921 with the re-creation of the Co-operative movement. So far as agricultural co-operative societies were concerned at this period the members were individual peasants, and they were very largely used for the purpose of combined purchase or combined sale. In the palmiest days of the 'New Economic Policy', as it was called, the number of members of such societies became over eleven millions or about half the peasant population of the country.

A new epoch, however, opened in 1928, and since that time while ordinary co-operation, as we have known it elsewhere has tended to decline, the organisation of communal agriculture has gone further than in any part of the world and been conducted on co-operative lines. The extent to which other forms of co-operative work have declined can be judged by the abolition of the urban consumers' movement in 1935—a form of co-operation which, when I first went to Russia in 1930, seemed universal and seemed likely to absorb all shop-keeping in the country.

But rural co-operation, centered round the collective farm, has developed marvellously, though with many changes of policy, many setbacks, and at one stage a narrowly avoided collapse, till it has become almost universal, either in the form of the collective farms themselves or in the rural consumers' movement which acts as a buyer of agricultural produce. In the present article I will limit myself to an account of the organisation and working of the collective farms themselves both as recorded in published reports, and also as I have seen it myself in the country.

It is well known that the ownership of land in Russia has been in some sense communal throughout the whole of history. It was only in the second half of the 19th century that the idea of peasant ownership came in the front. This being the case the transformation to a collective system, though full of difficulty was not nearly so revolutionary as it would be, for example, in India, where individual possession of land has very long history and is very deep-seated in the minds of the rural population. All the same, one of the first results of the communist Revolution in 1917 was the seizure of almost the whole of the agricultural land by the peasants. The large estates of the landlords were split up and, in spite of Communist theory, it looked as if the whole land would become a mass of

individual peasant holdings, though of course the community as represented by the State, demanded a much greater share in the produce than the State had ever taken before.

This continued, as I have already said, until 1928, when a genuine attempt was made to reconvert the mass of individual holdings in a village or similar area, into a communal holding. At this time however, there were a good many different views as to what the nature of the communal holding should be, how far it should go in taking account of all the possessions of each peasant, how far the area should be treated as one and also how far the management should be unified. There were some, in fact who wished that everything possessed by the peasants should be communalised, that is to say, should be treated as belonging not to individuals but to the community as a whole Some went so far as to consider that no peasant should hold individually even his house, his poultry or a milking cow. There was a time when it appeared as if this view was likely to dominate the situation but it was always resisted by the peasants over the greater part of the country, and the result of attempts to enforce it led to the slaughter of a very large proportion of the livestock in the country in 1932 and the early part of 1933, I fancy indeed that the whole of Soviet system came more nearly to a breakdown at this time than any other period of its history, largely owing to the resistance of the peasants to the complete collectivisation of property which was demanded.

As has so often happened during the re-organisation of Russia since the Revolution, the authorities realised the dangerous position of things in the early part of 1933, and a very famous decision was made at this time largely under the inspiration of Stalin whereby individual ownership was recognised over a very large part of a peasant's possessions. He was encouraged to have a milking cow of his own; to possess chickens and small animals of similar kind; to have a cottage and surrounding garden which belonged to himself; while at the same time the general agriculture of each collective unit continued to be run on a communal basis. The result is that at the present time it is estimated that four per cent of the rural land in Russia (1935) form the private gardens and other lands belonging individually, to the members of collective farms.

From 1933 the organisation has become fairly stable, and I think it may be said that the collective farm system of Russia is now well understood by the peasants, and works (at any rate in a fairly successful season) with no more friction or trouble than is the case with the agricultural organisation of a more old fashioned country. This result has, however, only been achieved by a very close co-operation between the State and the collective farms. Unless the State had been prepared to invest an enormous amount of capital in making it easy for the collective farms to work, and unless it had, moreover, been prepared to make the success of the collective system one of its primary purposes, I am sure that the present organisation could not have reached success. In fact, I feel (as a result of my Russian observations), if any country wished to develop a collective agricultural system its Government must make this a primary purpose of its existence and must be prepared to invest capital and energy in the struggle to make it a success, which is far beyond anything which seems to have been realised by any Government in the world outside Russia.

Let me now try to describe the organisation of a typical collective farm in Russia at the present moment The area of such a farm may include one or more villages and its area may run from say 234 acres upto 12,000 acres though over a greater part of the main corn-growing tracts of South Russia a collective farm will usually contain some-where from 2,000 to 6,000 acres. Usually, the collective farm is made so as to include one or more villages and there has been very little

cutting up of the old villages in order to make more convenient collective farms. In 1934 the average area per household in collective farms amounted to nearly 16 acres of which it was stated that nearly 13 acres were under grain or similar crops. Naturally this figure would vary enormously over different classess of cultivation and over different parts of the country, but the figures I have given are to give an idea of what is aimed at in these farms. Owing to the demand for labour in that rapidly developing industrial system in the towns and also for extending agriculture into new tracts in Siberia and elsewhere, the area per household has tended to increase since the collective farm system was first organised about 1928. It must be realised at once that in a collectivised village a peasant must either join the collective farm or cease to hold any land at all beyond the garden attached to his own house. Membership, however, is not a right of any inhabitant of a village and members can be expelled by the general meeting of the collective farm and new members likewise admitted even from other villages.

Such a collective farm as I have described is now a legal constituted body and will have received grants of land from the State, which are to be devoted to its use for ever. Its property includes the arable land and the common grazing ground of the village central farm buidlings, work animals, implements and the common herds of cattle, pigs, sheep or poultry.

The collective farm is governed by a small committee, elected from their own members for two years. The land is worked without reference to its previous ownership in the most economic way and the actual work of the farm is carried on by "brigades" each under a leader appointed by the committee. The "brigades" contain both men and women, while the care of livestock is usually a matter for the men.

But it must be clearly understood that the cropping of such a collective farm is not entirely at the option of the committee. Each collective farm receives each year from the Government a plan specifying how much grain and similar crops is to be grown, while for cash crops they are expected to grow a definite minimum of each of the products for which the place is suitable, for sale to the State factories. In fact, a contract has to be entered into at the beginning of each year with the State factories specifying the minimum amount for which any individual collective farm will be responsible.

An agricultural expert appointed by the State is usually, though not always attached to a collective farm and his advice will normally be taken, though the committee, are not compelled to do so. Further, in a greater part of Russia the State has established what are called Machine Tractor stations and from these, implements and tractors can be hired which are beyond the capacity of each collective farm to purchase for themselves, and seed and manures can also be obtained from them. The use of all the implements for the production of a crop including the use of tractors, will usually be charged at about one-sixth to one-fourth the normal yield of the crop grown and this will be paid for in kind.

The crops are, therefore, grown by the members of the collective farm with the assistance of seed, manure and implements as well as advice obtained from the nearest Machine Tractor station. When each crop is ready for harvest the whole is reaped and remains at the disposal of the Committee, of the collective farm. From the products so obtained the charges incurred in its production, including the land revenue payable to the State, have first to be set aside. In fact, the order in which the produce is disposed of will normally be as follows:

1. Delivery of a fixed quantity of grain or other crop per acre amounting to about one-sixth of the average yield to the State. This might be considered as

a form of land revenue but it is rather in the nature of a forced sale at a price which is only a fraction of that obtainable in the market. In the great grain-growing area of the Ukraine the amount of grain delivered under this arrangement amounts to about one to one and a half maunds per acre. It is a fixed amount based on the average yield.

2. The payment to the Machine Tractor Station for supplies of the manure, seed and advice, together with the hire of implements during the growth of the crops.

After these two payments have been made the rest of the produce belongs to the collective farm. Such a proportion of it as is necessary to pay the cash requirements is sold in the market collectively, and out of money so obtained the following items are paid for (1) the subsistence wages of the members of the collective farm which have been paid during the growth of the crop, or other wages due to the workers. I will deal with these wages later; (2) the agricultural tax payable to the State and amounting to about one fortieth of the cash income (3) all costs of production other than those due to Machine Tractor station; (4) the administrative costs of the collective farm which must not exceed 2 per cent of the cash income, (5) the purchase of equipment designed to increase the production of the collective farm and (6) any other expenditure for the improvement of the collective farm which is decided upon by the general meeting.

The whole organisation is simple except so far as concerns the wages payable to the workers on the collective farm during the production of the crops. To subsistence wages paid during the growth of crops, is added the amount which is earned by the worker according to the quality of his work, so that a small amount will be payable to each worker during the growing season and, it may be a larger amount at the end of the year when the produce has been sold. The calculation of the amount due finally to any individual worker is one of the most interesting features of the collective farm system. All farm labour is divided into seven groups according to the quality of the work done. In the highest of these groups which includes the best workers on the farm, each day's work is counted as two " labour days " In the lowest grade, on the other hand, a day's work is only counted a half a " labour day ". This unit of labour represents the amount which might be expected from an ordinary good labourer without special skill. If the amount of work done or the quality of work improves, the worker will be advanced to a higher group. If, on the other hand, it declines a worker may be put down to a lower group. The whole decision in this matter being made by the Committee of the collective farm.

After the payments which have been mentioned have been made the whole of the remaining produce is divided among the members of the collective farm who can store it or sell it or use it at their own free will. Most of it is, I fancy, sold to a rural co-operative society and this is the method which is generally favoured by the state authorities. Though there is no restriction on private sale of produce, yet it must be understood that this cannot lead to the growth of a private merchant's business because any such business is not permitted. If the sale, in fact is not made to a co-operative body it can only be made, at least in theory to an actual consumer.

The general system which I have described has not been reached all at once and it is quite possible that the organisation has not reached its final methods. Up to the present there has been such a demand for labour in connection with the new industrial development in Russia that there has been no pressure of population in the villages but, on the other hand the tendency has been for the number of members of any particular farm to decrease. This may not always be so and if the amount of land per member decreases it may bring back poverty

again where the collective farm system has temporarily removed it. The safeguard against this is represented of course by the enormous undeveloped areas in Russia, to which any excess population can go and will be able to go for many years to come, where every assistance will be given to new colonists who try to make an agricultural country from an undeveloped waste.

It will be seen that the system, if properly worked, should lead to the most efficient working of the land within the area of a collective farm, and as a result the actual production from the land is now tending to rise quite rapidly. To obtain this result of course means an enormous State organisation to assist the collective farm to make the best use of its land. Experience in Russia, as elsewhere has shown very clearly that there is no magic in the conversion of a large number of small scattered individual holdings into a collective farm. In fact, experience has shown that the production of such a collective farm may be less than that obtained by the members working each on his own holding. It is only where there is good leadership and satisfactory knowledge that the desired end can be achieved. And it would astonish anyone who has not been to Russia to see the amount of energy and training which has been expended in order to obtain the necessary amount of village leadership and to make available the requisite skill to the collective farms. In the absence of these two necessary things the collective farm system almost collapsed. With their gradual improvement and the consequent increase of production, the whole system seems to have passed beyond the critical stage and is now likely to become a permanent feature of rural economy in Russia.

I have not time in the present article to discuss the extent to which any similar scheme of collective farming is suitable for India. There are many difficulties in addition to those which have been met in Russia. Some of these are the intense pride in land ownership and all that this involves, the absence of undeveloped areas to anything like the same extent as in Russia into which the excess population could be drafted, the absence of industrialisation of the country to anything like the same extent as has been attempted in Russia, and finally, the existence of a large " middle-man " class whether existing as landlords, private merchants, money lenders, etc , all of whom had to be " liquidated " in Russia before the collective farm system could be a success. Unless these difficulties can be met and got rid of I do not think that the success of any collective farm system in India is likely to occur. Whether they can be got out of the way, except in a revolutionary period, is matter on which opinions may differ. But if these hindrances can be met, I think there is something to say for the collectivisation of agriculture as a means of improving the standard of life of the rural population in India, and the raising of the rural communities out of the abyss of bankruptcy in which they now lie. (*The Nagpur Agricultural College Magazine* Vol XIII No 3.)

ABSTRACTS

Some Biological aspects of the Storage of Fruit. By V. H. Blackman. *Science Progress* 33 : 417—434 (January 1939).

The paper presents a review of the results of some recent biological investigations on the storage of fruits. The Introductory paragraphs are devoted to a consideration of the processes of canning and refrigeration which have greatly extended the storage life of food products by replacing the old crude processes of salting and drying. The fruit, being a senescent organ, the object of storage is to retard the rate of biological processes responsible for decay.

The author discusses the various physiological changes taking place in the fruit. Four main processes are recognised—(1) surface evaporation (2) respiration (3) radiation and (4) evolution of volatile substances. Of these, respiration, the most important process influencing the storage of fruit receives exhaustive treatment.

That there is a temperature coefficient for the rate of respiration just as there is one for chemical reactions in general, has been experimentally demonstrated by Kidd and West of the Low Temperature Research Station, Cambridge. Data are given to demonstrate the effect of temperature on the rate of respiration and on the storage life of apples. Comparing the storage life of different varieties of apples at temperatures ranging from—1°c—18°c it is shown that leaving aside the direct injurious effect of very low temperature known as "low-temperature breakdown", while the mean life at 18°c is only 6—8 weeks, the period is lengthened from 5 to 8 months at 3°c or 5°c These data were further found to show that the temperature coefficient for the rate of decay is in the same order as that for respiration thereby demonstrating the intimate relationship between respiration and the storage life of fruits

Interesting and remarkable correlation is brought out between the phases of life history and phases of respiration of fruits. The phases of growth and senscence of fruit were found to correspond closely to the stages of the respiration life of the fruit distinguished as (1) pre-climacteric phase characterised fall in respiratory rate, (2) the climacteric stage when the rate of the process rises marking the beginning of the senscent stage and (3) post-climacteric stage which marks the climax of the respiratory rate which then falls again. In relation to cold storage, the low temperature greatly delays the development of the respiratory maximum during which period the ripening of the fruit occurs. The negative corelation between temperature and storage life is thus explained as due to the retardation of the rate of respiration.

The author further proceeds to trace the discovery of the action of ethylene in the ripening of fruits whieh was found to be due to its power in increasing the respiratory rate thereby hastening the appearance of the climacteric rise. Commercially the substance has been widely used for treating horticultural produce by releasing the compressed gas from cylinders in railway trucks during transport.

The author relates another recent discovery, viz., the capacity of apples to emanate a volatile substance comparable to ethylene. This observation was further confirmed by the "pea test" method of Smith and Gane who got results consistent with ethylene as the responsible agent. Further elaborating these discoveries, Kidd and West showed that (1) the main production from apple coincides with the climacteric rise in respiratory rate and (2) apple vapour passed over other immature fruits quickly induces ripening. The surprising fact is thus revealed, that "in a population of stored apples, there is some sort of social inter action, those that ripen first influence their fellows by their exhalation and bring them rapidly to maturity." Besides apples, bananas. peaches and pears (but not oranges or grapes) were found to give off this activating vapour.

Apple vapour being comparable in its action to ethylene, the latter has been demonstrated in apple vapour and found to be produced in varying quantities in all stages of development of the fruit which suggests the inference that the initiation of ripening under natural conditions may be due to a process of auto-stimulation, the apple tissue being stimulated by its self-produced ethylene.

The author mentions the injury to fruit known as scald characterised by browning of the surface resulting from storage in closed chambers. The nature

of the injury though still obscure, is attributed to the accumulation at the surface of the fruit of some volatile substances which can be avoided by oiled paper wraps which are supposed to facilitate the absorption of these substances.

The modern gas storage developed by Kidd and West is next described; it is based upon the principle of allowing the fruit to narcotise itself by the accumulation of the end product of respiration, Carbon dioxide, during storage in closed chamber. The fruit in a closed store is however exposed to the injury resulting from the excessive accumulation of one gas over the other which in the case of certain fruits may be neutralised by "regulated ventilation" while in certain other cases the system of chemical absorption may be necessary. To get over certain difficulties like the low-temperature break down, the system of refrigerated gas storage is now extensively employed by which gas storage is combined with some degrees of refrigeration. Although the physiological aspects of gas storage are still obscure, it has been recently observed that carbon dioxide though usually depressing respiration may at some stages of growth cause a rise in respiratory rate.

In the next part of the review is discussed the place occupied by fruit anatomy, in problems of fruit storage. Emphasizing the inter-dependence between physiology and anatomy, it is stated that in a gas store "it is not the atmosphere of the store to which the fruit reacts but its own internal atmosphere". Figures are given to show the correlation between respiratory activity on the one hand and cell size and number of cells respectively on the other. Measurements of inter-cellular atmosphere showed differences in the concentration of carbon dioxide and oxygen between internal and external atmosphere and the curves of these as well as of the respiratory activity are roughly parallel when plotted against time. The ratios of the corresponding values on the two curves give some measure of the porosity of the apple.

The next portion is devoted to a consideration of the importance of previous history of fruit in relation to storage. The manurial experiments of Kidd and West showed that potassium either given alone or combined with nitrogen or phosphorus markedly increased the storage life of oranges.

In the concluding paragraphs the mycological aspects of fruit storage are discussed. Wastage in a store due to fungal invasion is controlled not only by the natural resistance of the fruit but also by the degree of infection of the surface of the fruit. The method elaborated by Gregory and Horne to estimate the rate of radial advance of the fungus which gives a measure of the resistance of the fruit concerned is described and Horne's numerous studies of resistance to fungal invasion under a variety of conditions discussed. The results showed that while potassium heightens resistance, nitrogen reduces it. Thus the increase in storage life obtained by potash manuring may certainly be due to a physiological effect of potassium in retarding fungal invasion. The resistance of apple to fungal attack is also reduced with lapse of time. V. T. B.

The Relation of Copper and Zinc Salts to Leaf Structure. Reed, H. S.: *Amer. Jour. Bot.* 26; (1939) 29--33.

Tomato plants grown in copper-deficient nutrient solutions showed characteristic dwarfing, involution of the leaflets, color change, and eventual necrosis. At an early stage substomal cavities were formed, resulting from the separation of palisade cells. Subsequently the separated palisade cells shrunk and ultimately disappeared as a result of the lysis of the contents, producing columniated palisade tissue. If necrosis appeared, it started in these schizogenous cavities.

Tomato plants grown in zinc-deficient nutrient solutions showed characteristic dwarfing, curvature of leaflets, chlorotic leaflets, and involuted laminae in which severe necrosis appeared early. The palisade cells were longer and the spongy parenchyma was more compact than in similar leaves from healthy plants to which zinc had been supplied. The plastids were small and contained oil drops, but there were no free oil globules in the vacuoles. Conspicuous signs of disrupted metabolism were seen in the spongy parenchyma, identifiable as scarcity of plastids, production of melanotic material, and abundance of calcium oxalate crystals. (Author's summary.)

Research Notes.

WILD COLONIES FOR APICULTURE—WHERE ARE THEY ?

Introduction. Bee-keeping on modern lines has been, in a vigorous manner, kept in public view during the last few years with the publication of interesting articles in the press and demonstration in the districts. It has drawn its votaries mainly, as is to be expected, from among the leisured and well-to-do classes of people such as retired officials, lawyers, and land-holders. But even among these people, very few seem to have regularly taken to it, although, it cannot be denied, many of them evince a great deal of interest in the art. How often one comes across gentlemen, after purchasing the artificial bee-hive box, going in search of wild colonies only to find none! How often an Agricultural Demonstrator is made responsible for the finding of a wild colony! Wild colonies—where are they? In burrows of trees, crevices of walls and all inconvenient nooks and corners!

Pot-traps and how to arrange them. Pot-hiving which is known in some of the coastal villages of the Vizagapatam district for the sake of honey, can with advantage be chosen as a means of trapping and rearing wild colonies for ultimately transferring them to the artificial hives. Old mud-pots of about 1 gallon capacity and of the shape of a *chatti* that is used for cooking rice should be selected. Where new pots are used they should be thoroughly washed. A hole of nearly 1-inch diameter is bored into the bottom of the pot and its mouth is covered with a lid. If the pot happens to be of a bigger size, a second hole of half-an-inch diameter is to be made out in the bottom, away from the first. In any case, the lid should tightly fit the mouth; if necessary, sticky clay or wax may be used to make the lid adhere well. The pot in that condition is hung up in a secluded place on the branch of a tree like tamarind or *Pungam* (Pongamia glabra). Care must be taken to see that the pot does not dangle in the air too violently. This can be done by properly fixing the pot to the branch with sufficient coir rope.

Period of trapping. The best time for arranging the above pot-traps is before the swarming season commences. Generally it will be found that the period from January to May is suitable for the purpose. Cases have occurred that within a fortnight of their being set up, the pot-traps have become the abodes of bee-colonies. In a good secluded locality, fifty per cent. success should easily be obtained within an interval of 3 to 4 months. At any rate, for one who wants to start an apiary, two or three pot-traps properly set up beforehand will certainly give atleast one wild colony which is so keenly needed at the time.

Transference of a bee-colony from the pot to the artificial hive. The merit of the above method does not lie merely in the obtaining of a wild colony; but the ease and freedom it offers in the process of transferring the bee-colony to the artificial hive are of considerable value to the bee-keeper. From the time the new colony of bees is observed to have settled in the pot it is necessary, to

allow a period of one or two months to elapse in order to enable the colony to build its combs and rear its brood. At the end of the period. a bright morning is as usual chosen for the operation of the final hiving. The pot-hive is brought down in tact from the branch of the tree and tied to a lower branch or a horizontal post at a height of about 4 feet from which the operator can easily work. A few gentle knocks would bring down the entire bottom of the pot and the whole hive is exposed to the operator's eyes and, the rest can be performed in a comfortable fashion. The result of the operation is always a complete success since during the process very little violence would be found necessary to disturb the equanimity of the colony.

Conclusion. Pot-trap may usefully be employed as a means of obtaining a wild colony at hand. The advantages of this method are that it entails little or no extra expenditure, gives the least trouble in hiving into the artificial box and offers cent per cent success.

Chodavaram, 21—2—'39. G. V. Ratnam, Agrl. Demonstrator.

Gleanings.

Selecting the Deep Sucker in Banana Culture As the result of the favourable seasonal conditions, banana plantations are now making a flush of suckers. On the selecting of the best sucker on each plant will depend the success of the following crop and the future life of the plantation.

The corm of a banana plant produces at least two rings of buds which at growing periods burst into growth. Of these, the top circle is about 2 inches from soil level and the lower circle is usually 2 or 3 inches below the top circle. Suckers from any of these buds do not send forth the correct follower.

At the base of the corm a bud is produced which brusts into growth at a particular stage in the life of the parent plant. From plantation trials extending over several years it has been found that the parent plant sends out the correct follower sucker when it has made three quarters of its growth.

The maturity of a banana plant is governed, not by the time it is in the soil, but by the nature of the conditions during its growth. The deep flower produced at the right stage by the parent plant has more vitality, and its roots are deeper, and it retains its sword leaves longer. The shallow follower, on the contrary, develops its mature foliage early, and the corm rises above soil level, thereby preventing the effective functioning of its higher roots.

The careful digging out of a three quarter mature plant will reveal the habit of sucker formation, both shallow and deep. If suckers are planted with the side of severance downhill, the general experience is that the correct follower will invariably appear just where it is wanted—i. e., uphill. (*Queensland Agricultural Journal*, Vol. LI, part 1, January 1939.)

Dairy Cattle—Pure-Bred or Grades ? The question is often asked : Which is the more profitable pure-bred or grade daily cattle ? The difference in value of pure-bred and high grade dairy cattle lies in the higher selling price of the pure-bred. Dairy farms which are so equipped that they can handle the record work effectively will find more profit in pure-bred than in grade cattle. There is a steady market for high quality pure bred cattle at prices which get good returns to the breeder. Whether pure-bred stock will show the best results with any particular dairy farmer depends, however, on his keeping authentic records and also on his ability as a salesman. Pure-bred cattle which a breeder is unable to sell are no more valuable to him than an equal number of good grades.

A herd of carefully selected grade cows will produce as heavily as the average pure-bred herd for the reason that they can be culled more closely, as their lower value does not encourage keeping an animal which is not a profitable producer. There is always a good demand for the female offspring at payable prices. Any person going in for dairying for the purpose of producing milk or cream, and not with the idea of gaining a large part of his income from the sale of stock, may do quite as well with grades as with pure-breds.

As in most things, success with dairy cattle depends on the individual farmer himself, and whether grade or pure-bred cattle are more desirable can be settled only when the particular conditions surrounding the individual case are considered

It is sometimes stated that grade cows are better than pure-bred animals. This is not so, but it is true that some grades are better than some pure-bred stock.

One very important fact to remember, however, is that the herd sire should always be a pure-bred. Unfortunately, this is not sufficiently understood by some Queensland dairy farmers, and this accounts to a very large extent for the poor type of dairy cattle one sometimes sees when travelling through the country. (*Queensland Agricultural Journal*, Vol. LI, part 1, January 1939.)

Honey Dip for Ice Cream. If you wish to know what is really delicious, take a good grade of table honey and drizzle or pour it slowly over the surface of a dish of ice cream. The honey will congeal, that is, its viscosity will increase, so that the honey becomes waxy, and when this waxy honey and ice cream are eaten together, it makes a delicious mouthful. Try it out and see for yourself. When you have done that, go to the ice cream dispensers in your town and give a demonstration of how honey enhances the palatability of ice cream. (*Gleanings in Bee Culture*, Vol. LXVII, No. 1, January 1939).

Correspondence.

To

The Editor, Madras Agricultural Journal.

Sub.:—**Bamboos in flowers.**

Sir,

Since the flowering of bamboos is a rare phenomenon I thought it might interest the readers to know that bamboos have flowered this year in profusion. Flowering had commenced some weeks back and has been uniform and complete in both the solid and hollow varieties; both the young and old culms in the same clump have borne flowers very heavily. Perhaps this is about the best time for collecting seeds for raising bamboo in few areas.

The association of the flowering of bamboos with famine conditions is well-known. Older generation are still able to recall a similar flowering about 48 years ago in the Hindu cycle year 'Kara' when acute famine conditions prevailed. The continued prevalence of famine conditions now would seem to synchronize with flowering of bamboos again. Will any of your enlightened readers kindly let me know through the columns of your esteemed journal how and why the flowering is forced up in times of drought and whether this phenomenon has been observed in other parts of this presidency.

Chingleput, 30—3—'39.

(Sd.) K. Varadachari.

Agriculture in the Madras Legislature.

[The following is a press report of the proceedings of the 1939 budget session of the Madras Legislative Assembly relating to the Agricultural grant.—*Ed. M. A. J*]

In the Madras Legislative Assembly the Hon Mr V I. Muniswami Pillai, Minister for Agriculture and Rural Development, moved that the Government be granted a sum not exceeding Rs 20,11,100 under "Agriculture" in the budget for 1939-40.

Mr. G. Krishna Rao, (Northern Central Landholders) proposing a "cut" motion, complained that the Agricultural Department was static and had not helped agricultural progress in the province. The results of experiments conducted by the department and of the scientific work conducted at research stations had not been taken to the door of the ryot. There was, on an average, one demonstrator for each taluq; but as each taluq comprised about 300 villages the demonstrator could not serve the needs of even a small percentage of the ryots.

There was a wide gap between research station and the ryots and unless the results of research were carried to the ryots the department could not be said to have served its purpose.

The member wanted to know whether the Government had decided upon any definite policy on the application of electro-culture to agriculture.

Scientific Work. Mr. D. M. Reid (European Group) said agriculturists should follow the advice which the Agricultural Department offered them and benefit by the valuable results of scientific work.

He pointed out that agriculture was of supreme importance to the country and that those engaged in industry, in the professions and in fact in any walk of life, depended upon the prosperity of the agriculturists.

He showed the House a copy of the Villager's Calendar (priced one anna) published every year by the Agricultural Department and congratulated the Government on the publication. It was an excellent production and he wished that everybody read that book. He did not know, whether it was being published in the provincial languages also.

The Premier, by a nod of his head, indicated that it was being published in those languages.

Mr. Reid hoped that every agriculturist would follow the valuable advice contained in it.

He then referred to a Government *communique* on the working of the Mettur reservoir and congratulated the Minister for Public Information on that *communique.* He referred to a passage on irrigation, and said that the passage explained perfectly how the agriculturist should use the water available for irrigation.

The Agricultural Department was publishing valuable literature; but that literature should be studied by the people, he pleaded.

Mr. Reid added that he had already made certain alternative proposals for spreading education in agriculture among the people. His alternatives were that the students of all colleges should work on the fields for some time before they were considered qualified for their diplomas or degrees; or that agriculture should be included in the syllabus as a compulsory subject for the S. S. L. C. examination. Another suggestion was that all people, both Europeans and Indians, should be given some instruction in agriculture as a necessary feature in the training for citizenship.

More Maistries Needed. Mr. Abdur Rahman Khan (Kurnool, Muslims) said the Agricultural Department had not been able to take complete stock of the situation of agriculturists so that their interests could be advanced. They needed education—education not for University degrees but education that would enable them to understand how they could improve agriculture. Government, however, had not been slow in recognising the value of propaganda.

The department should utilise to a greater degree, the services of agricultural maistries who came in intimate contact with the agriculturists in villages and who, therefore, knew their exact needs and difficulties. Government should not only have a large number of demonstrators but also a large number of maistries. The department should assign plots of land to agricultural demonstrators.

Mr. T. N. Ramakrishna Reddi (Madanapalli) said Government had appointed an agricultural demonstrator in each taluq The mere appointment of demonstrators would not impart scientific knowledge of agriculture to ryots. Cooperation of the people was needed for the improvement of agriculture.

Imports of Fruits. Mr. Malang Ahmed Badsha (North Arcot, Muslims) said he did not think that any cleavage could be introduced between an agriculturist and a merchant. It was regrettable that India had to import apples from Japan, pineapples from Singapore and other fruits from California. It was a great humiliation to them, who claimed to be agriculturists from time immemorial. Could they not grow these fruits in their own country? The Government should consider this aspect of agriculture. The people also imported honey from other countries when their country was able to produce excellent honey.

Mr. Ahmed Badsha added that the total loss to this province on account of the practice of branding animals was between Rs 30 and Rs. 40 lakhs. Hide that could be sold for Rs. 4 was sold for Rs. 3 on account of the damage caused by the branding of animals. Government should consider this matter and bring in legislation to prevent branding of animals.

Even human beings were branded on account of superstition.

Mr. M. Subba Rao (Rajahmundry Rural) suggested that agriculture in the Presidency should be improved on new lines. Demonstrators had not discharged their duties properly.

In Cuddapah, during the past 20 years, new fruit farms had been established but they were destroyed by some disease The Government should assist the ryots to combat the disease. More marketing facilities should also be provided.

Mr. Sheik Mansoor Tharaganar (Tinnevelly, Muslim) said the Government should arrange to broadcast through the radio and the cinema the necessary information to agriculturists on economic methods of cultivation.

Mr. A. Subramaniam (Tirukoilur) said the Congress Government had done during the last 20 months more than what the Justice Party had attempted to do during the previous twenty years to improve the condition of agriculturists. During the remaining three years of office the Government would redress all grievances of the ryots.

Swami Sahajananda (Chidambaram, Scheduled Castes) said the poor agricultural labourers were helpless and uncared for. Though the Congress Government had done something for them, much remained to be done to improve their lot. The Government should undertake legislation to fix their hours of work and their wages. They should also make arrangements for educating the labourers' children.

Mr. Ramaswami Gounder (Palladam), speaking as an agriculturist, urged that the methods of work of agricultural demonstrators should be improved. The

demonstrators should identify themselves with the cultivators and apply their scientific knowledge to practical agriculture. They should move among the ryots freely and promote scientific methods of agriculture in a manner that would appeal to the cultivators.

He also pleaded that agriculture should be included in the elementary school syllabus.

Minister's reply. The Hon. Mr. V. I. Muniswami Pillai, Minister for Agriculture, replying to the debate, thanked Mr. D. M. Reid for his impartial view of the results of the work of the Agricultural Department under the present Government. Mr. Krishna Rao, the Minister regretted, had made sweeping remarks and had not studied the work of the department during the last 12 months.

Immediately after the present Government came into existence the Agricultural Department was reorganised, the number of Deputy Directors being reduced by 50 per cent. and that of Assistant Directors trebled. The number of agricultural demonstrators was increased by 30 posts so that one demonstrator might be appointed for each taluq. A maistry had been appointed to assist each demonstrator and there was a reserve of 45 maistries.

The department was not concerned with research alone. It undertook various other activities, such as evolving improved manure and seeds and promoting facilities for marketing the produce. The Department had produced various new strains of seeds and performed much valuable practical work.

He quoted figures showing increased cultivation of various crops such as cotton, potatoes and sugarcane, and pointed out that during the year 1937–38 the acreage had increased considerably over that of the previous year.

The Department had made great strides in improving the quality of crops.

Soil Analysis. He referred to charts showing the prices realised for various products and pointed out that they fetched better prices than they did formerly. Last year it was possible for the Department to analyse 2,541 soils from various parts of the Presidency and it was also possible to do research in regard to 46 kinds of grass in Coimbatore.

A member had referred to grants given to farmers in Orissa. But he would say that the Government of Madras had gone a step further. They had not only given grants but had also helped the farmers to sell their produce.

During the year 1937–38 loans amounting to Rs. 62·12 lakhs were given on the security of produce as against Rs. 26·16 lakhs in the previous year. The Department had also been giving grants to agricultural societies to construct godowns and also loans to the societies at the low rate of 3½ per cent.

Electro-Culture. The question was asked whether the Government had undertaken experiments under electro-culture. They deputed an officer to the United Provinces to study what was being done there in regard to electro-culture. This officer had come back and was making experiments. They expected to know the results in June.

Mr. Abdur Rahman Khan had said that much propaganda was not done. He would invite Mr. Abdur Rahman Khan to visit the various agricultural exhibitions held in the districts. Those exhibitions gave an idea of the activities of the Department.

Agricultural demonstrators were asked to tour at least 20 days in a month and were given opportunities to establish demonstration centres for better crops.

Fruit Research. Referring need to Mr. Ahmed Badsha's remarks about fruit growing and fruit research, the Minister said Government had established research stations in different centres in the Presidency, particularly at Kodur.

The member had also referred to the inadequacy of arrangements for the encouragement of bee-keeping. Government were doing all that they could to spread the industry throughout the Presidency.

Government had also circulated leaflets and pamphlets urging the people to stop the cruel habit of branding animals.

It was said that the posts of Agricultural Deputy Directors should be abolished. Government, after examining the position, had come to the conclusion that there should be four such Deputy Directors to cover the whole Presidency.

The Minister then gave the substance of his reply in Tamil for the benefit of members who did not know English.

Mr. G. Krishna Rao having withdrawn the "cut" motion, the demand was granted.

Crop and Trade Reports.

Groundnut—1939—First Report. The area sown with the summer or irrigated crop of groundnut during the three months January to March 1939 is estimated at 46,400 acres. When compared with the estimated area of 51,400 acres for the corresponding period of last year, there is a decrease of 9·7 per cent.

Figures by districts are given below :—

District.	Estimate of area sown with irrigated groundnut from January to March.		Increase (plus) or decrease (–) of the area in col. (2) as compared with area in col. (3).
	1939	1938	
1	2	3	4
	Acres	Acres	Acres
Anantapur	300	300	Nil
Cuddapah	2,000	2,000	Nil
Nellore	100	100	Nil
Chingleput	6,000	12,000	– 6,000
South Arcot	20,000	20,000	Nil
Chittoor	5,000	6,000	– 1,000
North Arcot	2,000	1,500	+ 500
Trichinopoly	2,000	1,000	+ 1,000
Tanjore	3,000	1,500	+ 1 500
Madura	5,000	5,000	Nil
Ramnad	1,000	2,000	– 1,000
Total	46,400	51,400	– 5,000

The wholesale price of groundnut (shelled) per imperial maund of $82\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important market centres on 11th April 1939 was Rs. 4—3—0 in Cuddalore, Rs. 3—15—0 in Vizagapatam and Anantapur, Rs. 3—14—0 in Guntur, Rs. 3—12—0 in Vizianagaram, Rs. 3—8—0 in Vellore, Rs. 3—6—0 in Cuddapah. Rs. 3—4—0 in Nandyal and Tadpatri, Rs. 3—3—0 in Bellary and Rs. 3—2—0 in Adoni and Hindupur. When compared with the prices published in the report for the corresponding period of the previous year, i. e., those which prevailed on 4th April 1938, these prices reveal a rise of approximately 19 per cent. in Anantapur, 8 per cent. in Nandyal, 6 per cent. in Bellary, Cuddapah and Vellore, 4 per cent. in Tadpatri and 3 per cent. in Guntur, the prices remaining stationary in Vizianagaram, Adoni and Hindupur.

Gingelly—1938–1939—Fourth or final report. The average of the areas under gingelly in the Madras Province during the five years ending 1936-1937 has represented 15·4 per cent of the total area under gingelly in India.

The area sown with gingelly in 1938–1939 is estimated at 821,000 acres. When compared with the area of 814,400 acres estimated for the corresponding period of last year, it reveals an increase of 0·8 per cent. The present estimate also reveals an increase of 3·3 per cent as compared with the finally recorded area of 794,875 acres last year. The area in an average year is estimated at 764,060 acres.

245,700 acres have been reported as sown since the previous forecast report was issued in January as against 268,000 acres during the same period last year These late sowings were mainly on wet lands in Vizagapatam, East Godavari, West Godavari. Cuddapah, Nellore, South Arcot, Trichinopoly and the South where gingelly was raised as a second crop after paddy.

As compared with the actual area sown last year, there has been an increase in area in the Circars (Vizagapatam excepted), the Deccan (Kurnool excepted) Nellore, Chittoor, Trichinopoly, Madura and Tinnevelly, partly counterbalanced by a decrease in the other districts.

The yield is estimated to be normal in East Godavari, Guntur, Kurnool, Ramnad, Tinnevelly and South Kanara and below normal in the other districts, especially in Coimbatore (66 per cent), Trichinopoly (67 per cent), and South Arcot (70 per cent) owing mainly to drought. The condition of the late sown crop is generally fair.

The seasonal factor for the Province as a whole works out to 87 per cent of the average as against 89 per cent according to the Season and Crop Report of last year. On this basis, the yield is estimated at 96,300 tons as against 95,900 tons according to the Season and Crop Report of last year and an average yield of 104,020 tons.

The wholesale price of gingelly per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 11th April 1939 was Rs 6—9—0 in Trichinopoly, Rs. 6—2—0 in Tinnevelly, Rs. 6—1—0 in Salem, Rs. 6 0—0 in Cocanada, Rs. 5—14—0 in Cuddalore, Rs. 5—11—0 in Tuticorin, Rs. 5—10—0 in Vizagapatam, Rs. 5—8—0 in Vizianagaram, Rs. 5—7—0 in Rajahmundry and Rs. 5—1—0 in Ellore. When compared with the prices published in the last report, i e., those which prevailed on 6th February 1939, these prices reveal a rise of approximately 13 per cent in Vizagapatam, 11 per cent in Tuticorin, 7 per cent in Vizianagaram and 4 per cent in Cocanada and a fall of 9 per cent in Ellore, 8 per cent in Rajahmundry and Tinnevelly, and 5 per cent in Cuddalore, the prices remaining stationary in Salem and Trichinopoly.

(From the Director of Industries and Commerce, Madras.)

Cotton Raw. in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 21st April 1939 amounted to 109,779 bales of 400 lb lint as against an estimate of 375,800 bales of the total crop of 1938–39. The receipts in the corresponding period of the previous year were 106,643 bales. 105,385 bales mainly of pressed cotton were received at spinning mills and 30,299 bales were exported by sea while 56,692 bales were imported by sea mainly from Karachi, Bombay and Egypt.

(From the Director of Agriculture, Madras).

College News and Notes.

Students' Corner. The University Examinations for the B. Sc. Degree in Agriculture commenced on the 3rd of this month. The theory portion was completed on the 24th instant.

On 28—3—39, the 1st and 2nd year B. Sc. (Ag) students were 'At home' at the Freeman Hall to the outgoing final year and short course students. After tea, speeches on behalf of lecturers, tutors, and coaches were made The function came to a close with an appeal by the Principal to the outgoing students to become active members of the Madras Agricultural Students' Union.

Personal. On the eve of his transfer from Coimbatore to Madras as Headquarters Dy. Director of Agriculture, Sri. K. Unnikrishna Menon was entertained at dinner on 28—3—39 by some of his friends and admirers at the Officers' Club.

Visitors. Sri. K. Lakshmana Rao, Madura, Honorary visitor, visited the Agricultural College and Research Institute on 5—4—39.

As examiners for the University Examinations for the B. Sc. (Ag.) Degree in Agriculture, the following gentlemen visited the Estate :— Sri. Bachina Ramayya, Dy. Director of Agriculture, I circle, Cocanada, Sri. B. C. Appadurai Mudaliar, Industrial Engineer to the Government of Mysore and Sri. G. Krishnaswami Mudaliar, Retired Veterinary Assistant Surgeon.

Notifications.

The following letter dated Calicut, the 10th April 1939 has been received by the Secretary, Madras Agricultural Students' Union from the Kerala Plantations Limited, The Madras Peoples Bank premises, Oyitty Road, Calicut. Intending applicants may submit their application direct to the Kerala Plantations Limited :

We shall esteem it a favour if you will assist us in getting a suitable Graduate in Agriculture to take charge of the Estates belonging to the above plantation Company. The Estates are situated in Malabar District.

The candidates you recommend should be below 32 years of age and physically fit to reside on the Estates.

We are agreeable to offer him an initial salary of Rs. 50 plus an allowance of Rs. 10 and free quarters on the Estate. He will be on probation for a period of 6 months and will be confirmed if his work is found satisfactory. The candidates whom you recommend may have to interview the Visiting Director of the Company (M. R. Ry. Rao Bahadur N. S. Kulandaiswami Pillai Avl., Dy. Director of Agriculture (retired) Crawford, Trichinopoly)

For the right type of Graduate the job we offer will be found very attractive and remunerative in due course.

The jollowing letter 569/39 E. dated 14—3—39 received by the Principal, Agricultural College, Coimbatore, from the District Forest Officer, Salem North, Hosur Cattle Farm, has been sent to us for publication in the Journal.

'I thank you for your letter under reference, and for having notified my requirements through the Secretary, Madras Agricultural Students' Union.

As a result of the notice, I have received six applications so far ; one is from a present student of your college and another from a man who has had some experience in collecting and insect pinning work. I am appointing both these as fieldmen. The remaining 4 applicants have had no experience whatever in collecting insects and are mere S. S. L. C.'s.

I shall be greatly obliged if you will very kindly have it notified that the applicants for the fieldmen's posts in this division should have some Entomological knowledge, in addition to the qualifications already specified '.

Weather Review—MARCH 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	1·4	−0·9	1·4
	Calingapatam	0·2	−0·2	0·4
	Vizagapatam	2·7	+2·4	2·7
	Anakapalli*	1·5	+1·0	1·6
	Samalkota*			
	Maruteru*	1·1	0·0	1·2
	Cocanada	2·0	+1·5	2·2
	Masulipatam	0·4	+0·1	0·4
	Guntur*	0·5	+0·3	0·5
Ceded Dists.	Kurnool	0·0	−0·3	0·0
	Nandyal*	0·1	−0·1	0·1
	Hagari*	0·0	−0·2	0·0
	Siruguppa*	0·1	−0·2	0·1
	Bellary	0·0	−0·2	0·0
	Anantapur	0·0	−0·2	0·0
	Rentachintala	1·0	...	1·0
	Cuddapah	0·4	+0·3	0·5
	Anantharajupet*	0·6	+0·5	3·5
Carnatic	Nellore	0·1	−0·1	1·1
	Madras	0·2	0·0	0·9
	Palur*	0·3	−1·6	3·3
	Tindivanam*	1·1	−0·4	1·7
	Cuddalore	0·3	+0·1	3·8
Central	Vellore	0·3	+0·1	2·3
	Salem	0·9	+0·4	1·5
	Coimbatore	0·4	−0·1	2·7
	Coimbatore A. C. & R. I.*	0·5	−0·3	2·6
	Trichinopoly	0·0	−0·4	1·9

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	0·2	−0·1	1·6
	Aduthurai*	0·3	−1·1	2·7
	Madura	1·3	+0·8	2·6
	Pamban	0·0	−0·5	3·3
	Koilpatti*	0·2	−0·7	2·8
	Palamkottah	0·7	−0·3	3·0
West Coast	Trivandrum	0·2	−1·4	1·3
	Cochin	2·3	+0·3	2·3
	Calicut	0·0	−0·5	0·1
	Pattambi*	1·1	+0·1	1·1
	Taliparamba*			
	Kasargode*	0·0	−0·5	0·0
	Nileshwar*	0·0	−0·3	0·0
	Mangalore	0·0	−0·1	0·0
Mysore and Coorg	Chitaldrug	0·0	−0·2	0·0
	Bangalore	0·4	−0·1	1·0
	Mysore	0·8	+0·5	1·1
	Mercara	0·1	−0·5	1·0
Hills	Kodaikanal	0·9	−1·1	9·4
	Coonoor			
	Ootacamund*	0·9	−0·2	2·3
	Nanjanad*	1·4	+0·3	2·6

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette

During the 3rd week of the month there were isolated thundershowers in the Peninsular area. Rainfall was slightly in excess in the Circars and defective elsewhere.

Skies were moderately to lightly clouded in South East Madras and North Madras Coast and the humidity was in large defect.

Weather Report for Agricultural College & Research Institute.

Report 3/39.

Absolute maximum in shade.	99·0°F
Absolute minimum in shade.	59·5°F
Mean maximum in shade.	95·3°F
Departure from normal.	+ 0·5°F
Mean minimum in shade.	67·2°F
Departure from normal.	− 2·5°F

Total rainfall for the month.	0·5"
Departure from normal.	- 0·3"
Heaviest fall in 24 hours.	0·5"
Number of rainy days.	1
Mean daily wind velocity.	2·6 m. p. h.
Departure from normal.	- 0·1 m. p. h.
Mean humidity at 8 hours.	60·8 %
Departure from normal.	- 8·9 %

Summary. Excepting for a thundershower on the 17th the weather was dry throughout the month. The rainfall was slightly in defect. The mean maximum temperature was very nearly normal while the mean minimum was below normal. Skies were lightly to moderately clouded and the humidity was in large defect.

P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notification.

Appointments and Transfers.

Sri K. Unnikrishna Menon, Assistant Director of Agriculture and Officiating Deputy Director of Agriculture, IV Circle, Coimbatore, in Category 4, class I Madras Agricultural Service is appointed to category 2, Class I, Madras Agricultural Service, and to officiate as Headquarters Deputy Director of Agriculture, Madras, vice Sri K. T. Alwa on leave.

Sri C. Ramaswami Nayudu, Junior Lecturer in Agriculture and Assistant Superintendent, Central Farm, Coimbatore is appointed to category 4—class I Madras Agricultural Service and to officiate as Deputy Director of Agriculture IV circle, Coimbatore vice Sri K. Unnikrishna Menon.

Name of officers	From	To
Sri L. Narasimha Acharya,	Offg. Asst. D. A., Nellore,	A. D., Chittoor.
,, R. N. K. Sundaram,	Asst. D. A., Madura (on leave)	Asst. D. A., Nellore.

Subordinate Services.

1. Transfers.

Name of officers	From	To
Sri C. S. Gopalaswami Rao,	Asst. in Mycology, Guntur	Asst. Mycology, Coimbatore.
,, M. Royappa Pillai,	Asst. in Millets, Coimbatore,	Offg. Asst. in Paddy Section, Coimbatore
,, A. Mariakulandai,	Offg. Asst. in Millets, Coimbatore,	Offg. Asst. in Chemistry, Coimbatore.
,, James Colaco,	Offg. Asst. in Chemistry, Coimbatore,	Offg. F. M., A. R. S., Nanjanad.
,, R. Krishnamurthy,		F. M., A. R. S., Kovilpatti.
,, V. Chidambaram Pillai.	F. M., A. R. S., Kovilpatty,	A. D., Tinnevelly.
,, S. Ramachandran,	A. D., Tinnevelly,	A. D., Mudukalathur.
,, S. V. Parthasarathy,	A. D., Chittoor,	A. D., Trivellore.
,, P. Seshachalam Naidu,	A. D., Kaikalur,	A. D., Narasapur.
,, B. P. Papayya,	Asst. A. D., Narasapur,	Asst, A. D., Kaikalur.
,, K. Parameswara Menon,	A. D., Dharmapuri,	A. D., Palghat.
,, P. V. Hanumantha Rao,	A. D. (on leave)	A. D., Vridhachalam.
,, R. Venkataramana Iyer,	Asst. A. D., Vridhachalam,	Asst., A. D., Mayavaram.

2. Leave.

Name of officers.	Period of leave.
Sri J. D. David, Lecturer in Animal Hygiene, Coimbatore.	L. a. p. for I month from 24—4—39.
„ P. S. Venkatasubramaniam, F. M., A. R. S., Tindivanam.	L. a. p. for 15 days from 12—4—39.
„ U. Ananda, F. M., A. R. S., Pilicode.	L. a. p. for 13 days from 17—4—39.
„ S. Ramarao, A. D., Udayagiri.	L. a. p. for 1 month from 25—4—39.
„ S. Dharmalingam, Asst. in Paddy, Coimbatore.	Extension of l. a. p. for 23 days from 6—4—39.
„ V. Ratnaji Rao, A. D., Sulurpet.	L. a. p for 21 days from 20—4—39.
„ B. Narasimha Pattathan, Asst., A. D., Puttur.	L. a. p. for 1 month from 12—4—39.
„ B. G. Narayana Menon, Offg. F. M., A. R. S., Nileswar.	L. a. p. for 30 days from 12—4—39.
„ N. C. Tirumalachary, F. M., Cotton Breeding Station, Coimbatore.	L. a. p. for 1 month from the date of relief.
„ K. C. Thomas, F. M., Central Farm, Coimbatore.	L. a. p. for 2 months from 12—4—39.
„ G. Ranganathaswami, F. M., A. R. S., Anakapalli.	L. a. p. on m. c. for 1½ months from 16—4—39.
„ S. Muthuswami, A. D., Tiruttani.	L. a. p. for 4 months from 12—4—39.
„ K. Hanumantha Rao, A. D, Rajampet.	L. a. p. for 2 months and 2 days from 27—2—39.
„ M. Krishnaswami Ayyangar, Asst., A. D. (on leave).	L. a. p. for 6 weeks from 18—3—39.
„ P. Nagadhara, A. D. (on leave).	L a. p. for 1 month and 15 days from 19—4—39.
„ K. Achuthan Nambiar, Asst., A. D., Mycology, Tellichery.	L. a. p. for 2 months from 12—4—39.
„ K S. Ramana Rai, A. D., Moodbidri.	L. a. p. on m. c. for 1 month from the date of relief.
„ P. Gopalakrishnan, F. M. (on leave), Nanjanad.	L. a. p. for 2 months and 10 days from 15—3—39.
„ U. S. Ayyaswami Ayyar, A. D., Mayavaram.	L. a. p. for 4 months from 3-4—39.
„ M. Gopala Unnithan, A. D., Gudiyatam	L. a. p. for 1½ months from 2—5—39.
„ P. Kesavanunni Nambiar, A. D., Palghat.	L. a. p. for 20 days from 12—4—39.

Agricultural College and Research Institute Coimbatore.

Additions to the Library During March 1939.

A. Books.

1. *Irrigation: A Selected Bibliography.* Graf, D. W. (1938). 2. *Plant Chemiculture: A Guide to Experiments in growing plants without soil.* Dawson, C. D. and Dorn, M. V. (1938). 3. *Morphological and Physiological studies on the fruitification of Peanut.* Shibuya, T. (1935). 4. *The Citrus Industry of South Africa.* Neumark, S. D. (1938). 5. *XIIth International Horticultural Congress.* (1938). 6. *Storage and Transport of Tropical Fruits and Vegetables.* Wardlaw, C. W. (1937). 7. *Manual for the Determination of Seed Borne Diseases.* Doyer, L. C. (1938). 8. *Background to Modern Science.* Needham, J. & Pagel, W. (1938).

B. Annual Proceedings and Reports.

1. Karachi Cotton Annual 1937-38. 2. Progress Reports from Experiment Stations of E. C. G. C. for 1937-38 3. Proceedings of the 12th Annual Congress of the South African Sugar Technologists' Association held in Durban 4th—7th April, 1938. 4 Year Book of Agriculture of the United States Department of Agriculture for 1938. 5. Annual Report of the Department of Agriculture—Tanganyika Territory Part II, 1937. Annual Report of the Department of Agriculture—Kenya Vol. 1, 1937. 7. Annual Report of the Director, Purdue University for 1937. 8. Annual Report of the Department of Agriculture and Conservation of Rhode Island and Providence Plantations for 1937.

C. Special Reports and Publications,

9. Report on the Cost of Production of Crops in the Principal Sugarcane and cotton tracts in India Vol. IV Madras, I. C. A. R.. 10. Report on the Cost of Production of Crops in the Principal Sugarcane and cotton tracts in India Vol. V Bihar, 1938. 11. Report on the Cost of Production of Crops in the Principal Sugarcane and cotton tracts in India Vol. VI Bengal, 1938. 12. Summary of Fertilizer Experiments carried out by I. C. I. from April 36 to March 1938 Vols. 1 and 2. 13. I. C. A. R. Report on a Village Enquiry re. Cattle and the Production and Consumption of Milk in seven Breeding tracts of India, 1938. 14. A Brief Survey of some of the Important Breeds of Cattle in India, Pt. II. 15. Definition of Characteristics of Seven Breeds of Cattle of All India Importance. 16. Cold Storage of Fruits and Vegetables. I. C. A. R. Miscellaneous Bulletin No. 2 by C. S. Cheema, D. Sc., I. A. S., and D. V. Karmarkar, M. Sc., Ph. D., A. I. I. Sc.

The Madras Agricultural Journal.

(ORGAN OF THE M A. S. UNION)

Vol. XXVII.] MAY 1939 [No. 5.

EDITORIAL

Colonies for Agricultural Graduates. Much has been said and written in recent times about the utility of starting agricultural colonies for the educated unemployed. "Back to the land" has been prescribed as one of the potent specifics against the chronic drift of the intellectual power from our villages to urban areas and against the too obvious preference amongst our educated persons to petty Government posts on starvation wages over the healthy and manly though arduous life of the agriculturist. The critics of this scheme deplore that, agricultural profession at present is uneconomic and that our present system of education does not fit our young men for the monotonous and the none-too-safe profession of our rural parts. There is also the point raised by the Government that suitable land for agricultural colonisation is not plentiful. No apology is needed for publishing elsewhere in these pages a scheme prepared by one of our Agricultural graduates for the acceptance of the Government. We do not overlook the fact that the scheme elaborated therein is not entirely flawless. In fact no such scheme can possibly be complete in itself at the initial stages when the details for the site selected for the colony have not even been fully gone into. This, however, should not preclude us from expressing our opinion on the essentials.

In reviewing a scheme of the type under consideration it is necessary to recall the experiences gathered from past attempts. The Annamalai University scheme for colonisation is one such scheme attempted in this presidency, while the unemployed graduates colonisation scheme in the Punjab and the Anglo-Indian colonisation scheme in Bihar are two notable examples in other parts of India. Reports are contradictory about the success of these ventures, but one outstanding thing that comes to light from these various attempts is that, any such scheme to be successful should embody the following essentials.

(1) A sufficiently large holding for each individual.

(2) Adequate capital to tide over the initial period of the life of the colonist.

(3) A planned scheme of cropping, providing a large area to be planted under remunerative crops.

(4) A co-operative system of purchase of requirements and sale of produce.

(5) Adequate number of educated colonists, to provide a corporate life and an enlightened social atmosphere.

(6) Men trained in the profession.

(7) Effective control by the Agricultural Department.

We are satisfied that the scheme described in these pages has attempted to fulfill all these conditions. We are particularly happy to note that the scheme is on the model of the "fruit grants" so successfully in operation for over two decades in the canal colonies of the Punjab. The Indian Mildura Fruit Farm, consisting of an area of about 750 acres granted by the Punjab Government to Captain Mitchell and the Montgomery Fruit Farm covering an area of about 175 acres granted to Dr. G. S. Cheema about 15 years ago are standing examples of the success of colonisation schemes on large holdings. In these two instances the Government did not give any financial assistance to the grantees, but in the scheme under review, suitable financial aid is sought from the Government to offset the smaller area earmarked for each lessee.

The scheme is so prepared, that in the long run it is expected to be definitely a paying proposition to both the parties. The success of the project would depend a great deal on the right type of personnel selected for the scheme. We hold that the scheme could be turned to success and would eventually establish beyond doubt the value of training imparted in the Agricultural College and Research Stations. The scheme is well worth a trial and we sincerely hope that the Government will be pleased to give their support to the scheme. It takes nearly a decade to know how a scheme has fared and any new scheme should not be held up on the score that a final verdict on the success of the previous scheme is not available. Good agricultural material is made available every year and it is well such material is used up in some scheme or other without allowing it to go to waste. We feel confident to say that the training given in the college here would justify itself if scope for its expressions is held out as suggested elsewhere.

Tea Cultivation in S. India.

By E A. STONE,

Gajam Mudi Estate, Anamalais.

(Continued from page 121.)

Pruning and Plucking. By two and half to three years from planting the tea plants will have grown to a height of roughly seven feet, and the stem will be about an inch thick at the bottom. It is now time for the first prune, which simply consists of cutting across the stem at about 3″ above ground level. The result is that a number of branches grow up and out from the stump. These are left to grow for about two years more, and then pruned again at 9 inches. When the new shoots grow again after the 9″ prune they are 'tipped', or broken across, at about 6″ above the pruning level i. e. 15″ from ground level. Usually about 3 tipping rounds are necessary at intervals of 10 days or so to get all the primary branches tipped in to a level, and the time from pruning to the first tip is roughly 3 months—depending on the weather. The leaf obtained during the tipping rounds, i. e. from the primary shoots, is big in size, contains a very high percentage of water in comparison with other leaf, and would make very poor quality tea. It is qenerally thrown away. When the secondary shoots are well grown it is time for the first round of 'plucking'. The first leaf to be formed in the secondary shoot is very tiny and smooth edged, and is called the 'fish leaf'. Thereafter the ordinary big leaves are formed alternately on eaoh side of the stalk. The method of plucking is to break off two open leaves and a bud leaving one big leaf above the 'fish leaf' (see figure—1). The big leaf that is left forms the mother leaf for the new shoot which will grow in its axil.

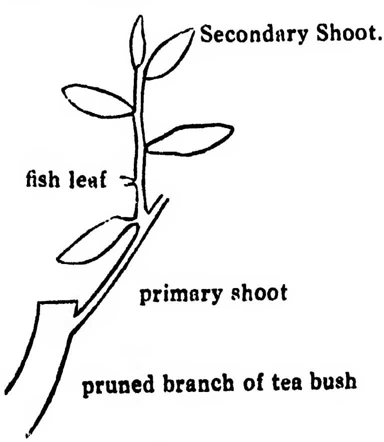


Fig. 1.

For the fist year and a half or two years after pruning it is usual to try to keep a definite level surface on the bush by plucking nothing below the level and breaking back high shoots. This does not mean that the bush is

kept down to the original tipping level all this time. This would necessitate very hard and continual breaking back which would eventually kill the bush. In the bad seasons, especially, the level is raised gradually by reducing breaking back to minimum. In vigorous growing seasons hard breaking back is necessary to keep the levels of the bushes and stop them from growing up out of control. Many planters allow all shoots above the level to be plucked to the fish leaf also, during the 'rush months'. These are usually April and May when showers of rain punctuate the periods of hot sunshine, and herald the approach of the monsoon. One bad season is June—July—August when the sun is scarcely seen, and high winds and rain are the prevailing conditions, with periods of fog and mist in between. The other bad season is the dry weather—January, February, and first half of March as a rule. The months between the monsoons and the dry weather when the rains are diminishing and the sun appears more, produce good crops but not as good as April and May.

To continue with the story of the tea bush, most planters prune on a three year cycle, and usually twice a year. That is twice a year 1/6th of the area of a tea estate will be pruned. Some start pruning in the monsoon and go on steadily until 1/3 of their estates are pruned. Some prune out every 2½ years, but it is argued that while this may increase crop (as crop drops in the third year from pruning) it reduces quality, as leaf from more mature branches gives better quality than that from green immature shoots. A few prune every four years but this usually means that the tops of all bushes have to be 'skiffed' (slashed across) after the third year. A bush which being pruned again after three years is plucked to a level for at least half that period for a number of reasons. First the spread of the bush is being increased as the slow growing side branches are being left unplucked and so thicken out and form good wood at their bases. Secondly by leaving all the leaf below the level in the centre and on the side branches, the bush is able to carry on with the formation of its organic food, even though the vigorously growing centre branches are being continually broken back, and the whole top surface is being plucked. Thirdly a far bigger surface of bush is able to absorb the sun's energy in this way, than if the bush were cone-shaped so that a healthier bush and a larger crop results.

After the second prune subsequent prunes are usually at 3 inches above each preceding pruning level, and subsequent tippings are at 4 to 5 inches above the pruning levels, though some planters prefer a higher tip.

When pruning, the ideal to be aimed at is an even distribution of points, or pruned branches, so that bunches of branches growing up in one place are thinned out by cutting some off at their bases. All cross branches running across the other branches instead of radiating outwards from the centre are cut off, all dead wood is carefully cleaned out, and living stumps shaved down to level with the new wood, so making it easy for new bark (callus) to grow over and cover the scar. Sometimes a few branches

are left unpruned so as to provide the bush with a little organic food-producing mechanism so reducing the shock of pruning. This method is known as 'lung-pruning'. It is unwise to leave too many of these "kickers" as they are called, for although they help the bush to bud much earlier and so come into bearing more quickly, the result will be an early appearance of 'banji' leaf.

A digression is necessary here to explain the 'banji' which is a leaf without a stem bud at its base. When a 'banji' leaf forms at the end of a stalk it means that for a time that stalk will not form any more leaves, and it is therefore a resting device, which if appearing in quantity, means a big reduction in crop. Healthy bushes do not run to 'banji' in any great quantities if plucked carefully for about two years from pruning, but much more 'banji' is formed in the third year. (It is for this reason that third year fields are usually called *'banji kadus'* Bushes which are brought back into leaf too quickly by leaving too many 'kickers' tend to form 'banji' one year after pruning.

To continue with pruning :— Some planters prune (and pluck) to flat level (*meshe mattam*), whereas others prune to the slope of the ground (see figures 2 and 3 showing the methods on a steep slope). It obviously makes little difference which method is used on ground which does not slope steeply, but on steep ground there is a lot of difference. The supporters of the flat method hold the view that sloping runs contrary to natural growth and gives a bush which is tremendously exaggerated on the upper side. The supporters of sloping, point out that they are forming a continuous cover so reducing weeds, and that flat pruning in later years when the bushes are bigger results in pluckers being unable to reach the lower halves of the bushes as they become exaggerated on that side.

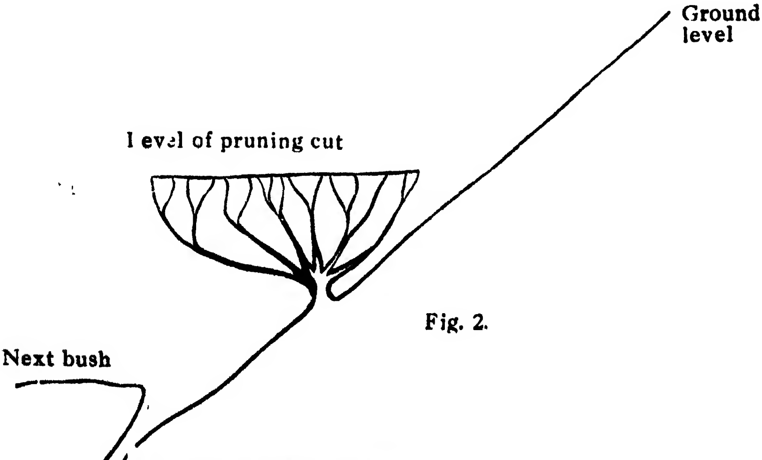
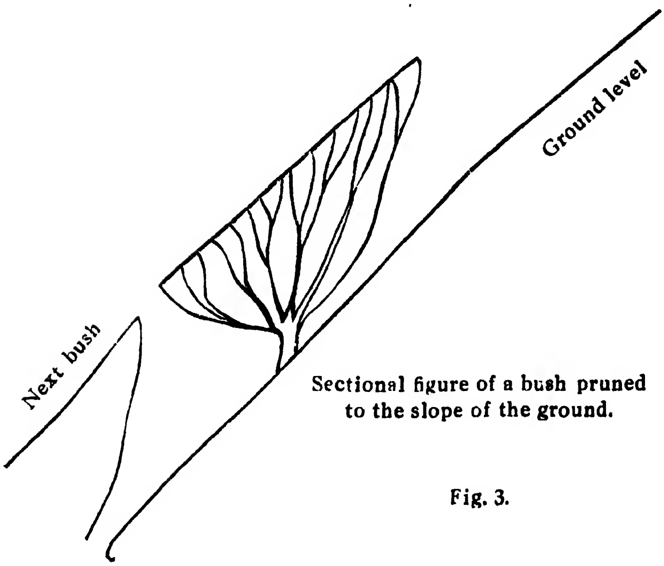


Fig. 2.

Sectional figure of a bush pruned to a flat level



Sectional figure of a bush pruned to the slope of the ground.

Fig. 3.

The possible answer is the happy medium as it is in most controversies (see fig. 4.)

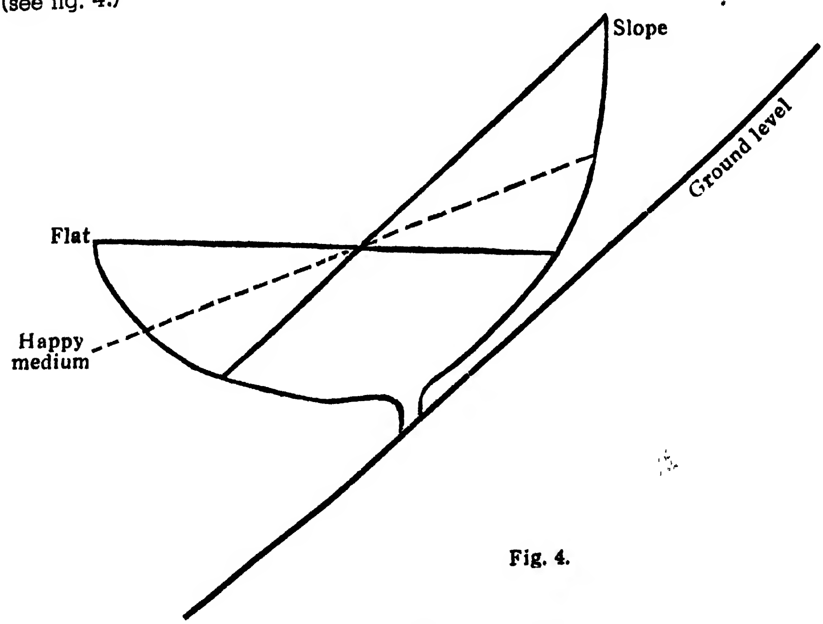


Fig. 4.

The dotted line shows the compromise, which gives a bush which is not exaggerated on either side, and is sloped sufficiently for plucking purposes even on steep ground.

A bush having the same amount of spread on either side should grow more evenly and the branches up which a uniform supply of sap is rising

should thicken evenly. After pruning it is well to smear wax or some sort of suitable water-proof dressing over the large cuts and scars on the bush, and moss, lichens etc. growing on the wood should be cleaned off. The prunings are best cut small and stacked in every other row, so leaving one row clear for subsequent forking or sowing the seed of nitrogenous cover crops.

Plucking. The plucked leaf should not be crushed, overwithered, or damaged in any way in the field, or in transit to the factory. Coolies pluck into baskets which they carry on their backs, and on no account should they press the leaf down in those baskets, or put leaf in their blankets or sarees which are close to the heat of their bodies. It is necessary therefore to weigh up the leaf at regular intervals and send it up to the factory. Weighments twice a day are enough in poor cropping periods, but three times and even four times are necessary in heavy cropping periods. The leaf is usually packed loosely into open work string bags for conveying to the factory. The leaf must not be crushed in the bags and it is best to put a uniform quantity in each bag, say 50 lbs. The bags are conveyed to the factory by the pluckers themselves from near-by fields, and by bullock carts, lorries, or ropeways from far away fields. Coarse leaf and stalk is picked out and thrown away before each weighment.

(To be continued).

Nitrogen Content of Suqarcane Juices and Colour of Cream Jaggery.

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Very early in the investigation of the process of cream jaggery manufacture (*Dept. of Agriculture, Bull.* 39, 1935), it was occasionally noticed that certain juices failed to yield cream jaggeries of superior colour and quality. These juices while becoming as colourless and clear as others after treatment with activated carbon, however developed a brownish colour towards the later stage of boiling. As the reason for the above abnormal behaviour was not well understood then, the quality of cream jaggery that may be expected from a particular juice could not be foretold with any degree of certainty and the demonstration of the new process was a fruitful source of anxiety to the men in charge ; but these adverse results were fortunately few and far between.

The above problem of colour production has been under investigation in the laboratory of the Government Agricultural Chemist for the past one year and as a result, certain tentative conclusions have been arrived at. Though the investigation has not been concluded, the results obtained so far are interesting enough and appear, therefore, to deserve a record.

As already mentioned, it was not every juice that could be made to yield high grade cream jaggery on carbon treatment. Among the refractory juices, were included juices from immature, diseased and lodged canes and it was argued that the factors operating in these cases were the high glucose content and the low purity of such juices. This conclusion appeared plausible as it is common knowledge that solutions containing reducing sugars, particularly invert sugar of levulose turn brown on heating and that the degree of browning is a function of the temperature and period of heating.

This explanation, however, appeared incomplete as certain juices though possessing low amounts of glucose and fairly high purity behaved, nevertheless, unsatisfactorily. P. O. J. 2878 was one such instance. It was grown in a garden land plot of the Central Farm, Coimbatore, Viz. in F. 59. The composition of the juice appeared by no means to be in defect as shown by the figures of analyses presented below.

Table showing the analyses of juice of P. O. J. 2878 grown in Field 59 of the Central Farm, Coimbatore.

Particulars	Dates			
	9—4—35.	21—3—35	17—3—35	1—3-35.
Brix.	19 80	19·00	20 36	20·38
Sucrose.	16·80	15 93	17·30	17·54
Glucose.	0·76	0 60	0·79	0·33
Coefficient of purity.	86·00	84 96	83 20	84·80

In spite of its good analysis, its behaviour during boiling was peculiar. Unlike the carbon-treated juices from other varieties, it developed considerable frothing during the course of concentration and subsequently the syrup turned brown and did not boil free. Further, the temperature of the boiling syrup could not be raised above 120°C without avoiding charring.

Co. 213 grown in the same plot, while not so good in quality of juice as P. O. J. 2878 exhibited the same undesirable characteristics during concentration for jaggery making.

Having found that the usual analyses of the juices viz. Brix, sucrose, glucose and purity did not furnish any clue towards an understanding of this problem, these juices were analysed in addition for total nitrogen.

As will be seen from the data presented below, the nitrogen content of the cane varieties grown in F. 59 was several times greater than that of the same varieties grown elsewhere.

Table showing variation in nitrogen content of juices of canes grown in different lands.

Variety.	*Age.*	*Where grown.*	*Total nitrogen.* %
Poovan.	11—12 months.	Central Farm, wet land.	0·020
,,	,,	Wet-lands, Perur, a village near Coimbatore.	0·024
,,	,,	,, ,,	0·020
,,	,,	Wet-lands owned by a ryot near the Central Farm	0·020

Poovan.	11—12 months.	Perianayakanpalayam near Coimbatore.	0·027	
,,	,,	F. 59 garden land, Central Farm.	0·113	Average of 6 results
Co. 213.	11—12 months.	Central Farm Wet lands.	0 026	
	,,	F. 59 garden land, Central Farm.	0·133	Average of 6 results.
P. O. J. 2878	,,	Central Farm wet lands.	0·048	
	,,	F. 59 garden land, Central Farm.	0·105	Average of 3 results
Co. 360.	,,	Central Farm Wet lands.	0·026	
	,,	F. 59 garden land, Central Farm.	0·110	

A more detailed analysis of the juice before and after treatment with activated carbon showed that more than 80% of the nitrogen was present in a soluble form, as may be seen from the data presented below.

Table showing nitrogen content of raw and filtered juices.

Co. 213 grown in F. 59 of the Central Farm, Coimbatore.

Date of analysis.	Particulars of treatment.	Brix. %	Sucrose. %	Glucose. %	Coefft. of purity.	Total N %	N x100 / Suc	N precipitated by Stutrer's reagent. %
12—3—36.	(a) Raw juice.	17·47	13·34	0·72	76·38	C·095	0 712	0·016
	(b) Treated with activated carbon and filtered.	21·32	17·96	0 93	84·25	0·099	0 551	0·005
14—3—36.	(a) Raw juice.	15·53	11·90	1·12	76·60	0·085	0·713	0 015
	(b) Treated with activated carbon and filtered.	17·83	14·70	1·46	79·23	0·095	0·641	0·004
	(c) Limed to excess – the excess lime removed with Co_2— then carbon treated and filtered.	18·21	14·10	1 50	77·50	0·097	0·688	0·004
17—3—36.	(a) Raw juice.	14 30	11·17	0·71	78·10	0·098	0·877	0 014
	(b) Treated with activated carbon and filtered.	16·50	12·94	0·82	78·40	0·100	0·773	0·004
20—3—36.	(a) Raw juice.	16 80	13·90	0·44	82·80	0·116	0·835	0·016
	(b) Treated with activated carbon and filtered.	30·3	24·43	1·20	80·60	0·185	0·757	0·004
27—3—36.	(a) Raw juice.	14·50	11·37	0·58	78·39	0·099	0·871	0·019
	(b) Treated with activated carbon and filtered.	15·49	12·25	0·67	78 09	0·105	0·857	0·004
	(c) Limed to excess— excess lime removed with Co_2, then treated with activated carbon, and filtered.	16 99	13·65	0·75	80·50	0·106	0·742	0·006

The data presented above suggest that the presence of an excessive amount of soluble nitrogenous substances is possibly responsible for the

browning of certain carbon-treated juices and this accounts for the inferior quality of cream jaggery. If this were so, the colour of cream jaggeries may be expected to bear a close relationship with their nitrogen contents and such was actually found to be the case as will be seen from the following results of analysis of several samples of cream jaggery.

Name of variety.	Colour of a 5% solution of the jaggery in units of the Lovibond tintometer for ½″ cell. Yellow.	Red.	Total nitrogen on dry basis.	Glucose per cent on dry basis.
1. P. O. J. 2878	16·0	5·3	0·46	9·21
2. 247 B	9·8	2·5	0·15	12·00
3. Co. 351	8·8	1·8	0·11	12·91
4. Co. 356	8·6	2·0	0·11	5·04
5. E. K. 2	3·6	1·3	0·07	13·39
6. Co. 417	3·5	1·1	0·05	11·81
7. J. 247 (Ambur)	1·5	0·5	0·04	7·5
8. Fiji B (Palur A. R. S.)	0·5	0·2	0·02	13·90

The soluble nitrogen content appears thus to exert a more pronounced influence on the colour of final jaggery than the glucose percentage. An experiment in which Poovan cane obtained from a neighbouring ryot's field was cut into bottom and top halves, the two portions crushed, analysed and made into cream jaggeries separately pointed to the same conclusion.

Variety of cane.	Particulars.	Brix. %	Sucrose. %	Glucose. %	Purity.	Total N	Remarks on jaggery.
Poovan.	Bottom half.	19·76	18·03	0·53	91·24	0·019	Very light yellow colour: hard.
	Top half.	18·76	15·95	1·10	85·04	0·022	Slightly deeper in colour: hard.

A simultaneous presence of excessive amounts of nitrogen and glucose in sugarcane juice is rather disastrous as evidenced by the following results.

Variety.	Brix. %	Sucrose. %	Glucose. %	Purity coefft.	Total N.	Remarks on the quality of jaggery.
1. Co. 213	16·61	13·87	0·20	83·50	0·130	Fairly good colour and fairly hard.
2. do.	15·48	12·07	0·27	77·96	0·090	About the same as (1).
3. do.	12·27	8·73	0·93	71·15	0·093	Much more brown than (2) and much softer.
4. do.	12·79	9·15	1·10	71·53	0·107	Just inferior to 3.
5. do.	11·67	7·95	1·10	68·10	0·130	Almost indistinguishable from the ordinary jaggery.

The experiments detailed above lead to the question viz., what are the particular form or forms of the soluble nitrogen that are responsible for the colour development in jaggery ?

A preliminary examination of the juice for different nitrogen fractions showed that amino-acid nitrogen formed more than 50 per cent of the total soluble nitrogen.

It has been shown by Roxas (1916) that several pure aminoacids produced brown-coloured humin substances on boiling with carbohydrates in the presence of hydrochloric acid. Gortner and Holen (1927) emphasised the importance of aldehydes in the formation of humins during the acid hydrolysis of proteins. Joolyin and Marsh (1935) attributed the browning of orange juice, in part at least, to the amino-acid sugar reaction.

To determine how amino-acids behave under conditions obtaining in the process of jaggery making, viz., a high temperature and a slightly acid reaction, glycine and asparagine were boiled separately with various sugar solutions viz., sucrose, dextrose and levulose individually and in mixtures and the colours of the resulting products compared with the aid of the Lovibond tintometer as per details below. In another experiment, a jaggery solution was decolourised with paddy husk activated carbon and the decolourised solution was boiled with and without the addition of asparagin. The results are recorded below.

Table showing increased colour development in the presence of amino-acids.

Particulars of experiment.	Total colour units of the Lovibond tintometer ½" cell (10% solution of the jaggery in water.)
1. Jaggery made from a solution containing 12·0% of sucrose and 1·0% of glucose.	0·5
2. —Do.— + 0·5% of asparagin.	1·3
3. Jaggery made from a solution containing 12·0% of sucrose and 1·0% levulose.	0·7
4. Do. + 0·5% of asparagin.	1·8
5. A 5% jaggery solution decolorised by activated carbon treatment.	0·3
6. 250 cc. of the above boiled for two hours, cooled and made up to the original volume.	1·6
7. No. 6 (above) + 0·6 gms. of asparagin.	2·4
8. Jaggery made from a solution containing 50 gms. of bazaar white sugar, 1·25 gms. of glucose, 1·25 gms. of levulose 1·0 gm. of amino acetic acid.	Reddish brown in colour.

It would appear from the above that the colour production under investigation is most probably due to the interaction between the amino-acids and the reducing sugars in the juice.

To obtain conclusive evidence on this point, it may be necessary to estimate not only the amino-acid content of different juices, but also the different fractions of nitrogen as well. Further investigation will, therefore, proceed on the lines just indicated.

Acknowledgement. We wish to acknowledge our indebtedness to Mr, P. V. Ramiah, M.A., B.Sc. (Edin.), Government Agricultural Chemist for

all the facilities afforded for the investigation and for his valuable criticism in the preparation of this article.

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A Scheme for Opening Agricultural Graduate Colonies By Government.

BY P. PARTHASARATHY, B. Sc. Ag.

The writer submits below a tentative scheme for the opening of graduate colonies designed to reduce unemployment. The scheme has been drawn up in consultation with experts.

I. The Government is requested to provide each individual with 20 acres of land on a 30 year lease. Land for this purpose is, I understand, now available at Settigunta near Kodur. This area is in close proximity to the Fruit Research Station at Kodur and expert advice from there can, therefore, be easily had.

II. It is also suggested that a central irrigation plant may be installed by the Government for purposes of irrigation. The initial cost of the installation may be borne by the Government but the maintenance of it may be undertaken by the lessees. The well would be available for use by the ryots of the neighbouring villages for drinking purposes, and as such, the initial cost on the same can be easily met with from the funds earmarked for the supply of drinking water for rural areas.

III. The area allotted to each individual under the scheme may be devoted to the following.

(a) 10 acres—under fruits.
(b) 1 acre —buildings, cattle-shed, threshing floor etc.
(c) ½ acre —vegetables.
(d) ½ acre —poultry and cattle.
(e) 7 acres—fodder and green crops.
(f) ½ acre —Nursery (citrus and mango grafts) with subsidiary home crafts like home-canning, spinning, rope-making, bee keeping etc. to be taken later.

Total. 20 acres,

IV. The amount required by the individual colonist would be as follows.

		Rs.
(a)	Buildings	1000
(b)	Levelling and fencing	500
(c)	Layout	200
(d)	Purchase of plants and implements (purchased from the Government nursery or raised by lessees)	500
(e)	First year working expenses	800
(f)	Miscellaneous farm requisites	250
	Total.	3250

The amount may be loaned by the Government to each lessee to be paid back annually during a period of 20 years with a small interest.

In case the lessees are in sufficient number, the purchase of implements and plants, erection of fencing and lay out of plots etc., can all be done on a co-operative basis; and similarly the produce may also be sold co-operatively.

V. Each lessee will be entitled to the entire produce from the area allotted to him for a period of 30 years, after which he will be allowed to purchase the farm outright, failing which it will pass into the hands of the Government with all the immovable properties.

VI. The scheme will provide the following benefits.

1. Provide employment to agricultural graduates,
2. Make valuable and fully established gardens and farms available to the Government, free of cost after 30 years.
3. Demonstrate to the educated unemployed, a means of honourable living and the value of co-operative farming.
4. Show the possibilities of converting large uncultivable waste area into profitable land.
5. Provide an agency for the rapid dissemination of the research work carried out by the Government farms, especially on fruits.
6. Prove the value of specialised farming of fruits, vegetables and flowers; and stimulate the extension of areas under these; and also aid in the availability of fruits in plenty for the improvement of nutrition of the people.
7. Lead to the establishment of reliable seed farms, providing the cheapest method of raising and supplying seeds and plants of improved strains; thus correspondingly effect a considerable saving to the Government.

VII. The only special expenditure the Government is called upon to incur is on the cost of pumping plant. The loans granted to the lessees will be repaid and are, therefore, not a charge on the Government. Recovery of the loan is easy, because of the co-operative disposal of the produce, under the *aegis* of the Government. Although the Government is

requested to sanction the scheme for the benefit of the unemployed graduates, the former stand to gain enormously, because of the availability of large established farms free of cost after 30 years, and of the release of uncultivable wastes for profitable cultivation, thus indirectly increasing the revenue assessments and effecting a corresponding reduction in the cost of Government seed farms.

VIII. The control of the scheme can be effectively secured in the same manner as of 'fruit-grants' in the Punjab, according to which the conditions imposed are:—

a) The lessee should himself stay on the farm and run it, failing which, a competent man approved by the Director of Agriculture should manage the farm.

b) The area to be allotted under each fruit or crops, the method of orchard maintenance and the general fulfilment of the other conditions are subject to the approval of the Director of Agriculture and are to be examined by six months' inspection by the Government Fruit Specialist, whose report has to be forwarded to the Government through the Director of Agriculture.

c) Failure to fulfil any conditions will entail the cancellation of the grant without any compensation. In addition to this, the Co-operative Department may be held responsible for the sale of the produce and recovery of the loans in annual instalments.

IX. It is suggested that a beginning may be made with a dozen graduates in one tract. If the scheme succeeds, it may be extended to other districts as well.

X. An idea of the expenditure and income to the lessee from nurseries alone during the initial stages of the working of the scheme is presented below. After about 10 years the income from fruit gardens will be, by itself, sufficient to give a decent profit to the lessees after providing for the repayment of loans and other recurring expenditure.

Nursery scheme.

	Citrus nursery for raising 20,000 budded plants.	Rs.	a.	p.
1.	Purchase of 6000 sour oranges for seed extraction. ...	80	0	0
2.	Extraction, selection of seed, at 4 annas for 250. ...	8	0	0
3.	Preparation of ground, seed-beds etc., to accommodate about 30,000 seeds.	15	0	0
4.	Sowing.	10	0	0
5.	Wages of one watchman who will be watching, weeding of seed-beds, etc., for 6 months at Rs. 7/— per month. ...	42	0	0
6.	Transplanting of about 20,000 selected seedlings.	50	0	0
7.	Preparation of ground, nursery-beds, and pits for 20,000 seedlings at Rs. 3/— per acre for preparation of land, Rs. 50/— for making beds and Rs. 50/— for digging pits.	112	0	0

8.	Watching, weeding and watering for 2 years at Rs. 3/— per irrigation (for 24 irrigations), Rs 6/— per weeding, (for 12 weedings) and Rs. 7/— per month for watchman.	572	0	0
9.	Selection of budwoods & budding at 100 per day. ...	112	0	0
10.	Cost of scion material.	48	0	0
11.	Tying materials and tools etc.	150	0	0
12.	Removal of stock sprouts and lopping.	90	0	0
13.	Miscellaneous.	200	0	0
	Total.	1,489	0	0

Receipts. By sale of 10,000 budded plants at 8 annas per plant.	Rs.	5,000	0	0
Deduct expenditure as per details above. ...	Rs.	1,500	0	0
Net profit	Rs.	3 500	0	0

Mango nursery for raising 600 grafts.

1.	Purchase of 1000 mango fruits of inferior seedling types. ...	15	0	0
2.	Extraction of stones.	2	8	0
3.	Preparation of beds.	5	0	0
4.	Sowing.	1	0	0
5.	One watchman for both citrus & mango nurseries. ...	—		
6.	Weeding and watching for one year.	27	0	0
7.	Transplanting of 600 seedlings into pots.	3	0	0
8.	Cost of pots, composts, crocks etc.	15	0	0
9.	Grafting expenses for 600 plants including tying ...	15	0	0
10.	Cost of scions.	12	0	0
11.	Separation of grafts.	1	0	0
12.	Watering and watch of grafts in pots till separation (5 months)	45	0	0
13.	do. for 3 months after separation. ...	21	0	0
14.	Miscellaneous.	12	8	0
	Total.	175	0	0
	Revenue by sale of 600 grafts at 6 annas each.	225	0	0
	Net profit.	50	0	0

Hence the net profit for preparing 20,000 grafts is Rs. 1,500.

Seasonal Variations in the Flight Activities of Bees.

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Introduction. That the flight activities of bees is to a large extent influenced by environmental factors is well recognized. But how far variations exist as between season and season or between hive and hive is much less known in India. In the present investigation the monthly variations of flight activities were studied.

Material and Methods. To enable the comparison of flight activities of bees some index of such activities is essential. The ideal method of measuring the flight activities will be to have a counting device which would indicate the number of bees that enter a hive or leave the hive on a given day. But with such a device it would not be possible to count separately bees bringing pollen loads and nectar loads. The flight activity in a colony is a continuous process commencing from sunrise to sunset, it being affected only by environmental factors. If during definite intervals the bees arriving at the hive during a period of, say, one minute, are counted, this count may be taken as a representative sample of the activity during such intervals in each colony and may form the basis of comparison. Ratnam (1938) counted the incoming bees during a period of one minute, at intervals of fifteen minutes. In the present study the same method has been followed, but the counts were made at hourly intervals; and separate counts were made of bees arriving at the hive with pollen as well as those without it.

According to Woodrow (1932) " the counts of bees leaving the hive is a better index to immediate effect of external conditions ", since between the time a bee leaves the hive and its return, there is an appreciable time interval, during which time environmental conditions might have undergone a change. But here again separate counts of nectar gatherers and pollen carriers cannot be made, and so Woodrow's method has not been followed in the present study.

Three hives of *Apis indica* of approximately equal strength were selected for the present study. The counts of incoming bees were made at hourly intervals during fortnightly periods commencing from the last week of August 1937 to end of August 1938, thus making one full year. It was not convenient to record counts in the first week of April 1938. Readings were taken, as far as possible, on two successive days. Out of 23 readings recorded, 16 are the average of two successive days. In other cases only a single day's readings are considered. The readings recorded on the 16 pairs of successive days are very highly correlated, the coefficients of correlation amounting to 0·8174 ± 0·05598, 0·8387 ± 0·05001, and 0·9393 ± 0·01987 in the the case of each of the hives A, B, and C respectively. This shows that reliance can, without doubt, be placed on those

readings recorded on single days as well. Two individuals were at work simultaneously for counting pollen gatherers and nectar gatherers respectively, and they changed their duties frequently with a view to obviate errors, if any, due to personal factors.

Variations in General Seasonal Trends. The index of flight activity for each day is taken as the total of the counts made at hourly intervals of bees returning to the hive per minute with pollen or without it. Such readings were taken from 6 a.m. to 7 p.m. Water carriers may perhaps be included in the counts for nectar gatherers; but that would not materially affect the flight index which is merely used for comparing the activities of three hives on different days. In Graph I these indices of flight activity in respect of pollen and nectar are plotted. The most remarkable feature of the graphs is their identical trends for all the three hives. In colony C a swarm issued a few days prior to 1st January 1938, and it was also rendered queenless between this date and 13th January 1938, so that the reproductive activity of the colony has been interrupted. After 1st January 1938, therefore, the conditions of this colony cannot be deemed to be comparable with the others. The similarity of the trends of the graphs can only be due to the fact that under identical environmental conditions bees of the same type work at the same rate. The graphs for nectar activity show remarkable peaks in the months of November to February, and April to June, when pasturage conditions are favourable in the locality as reported by Ratnam (1938 a.). The graphs for pollen do not show very high peaks because the number of bees engaged in collecting pollen is relatively much less. Here again the graphs for each one of the hives show similarity of trends. They indicate that a maximum field force is at work for collecting both pollen and nectar. If this were not so one graph may reach a peak at one time when another is not so, and large variations would have been noticed.

Proportion of bees engaged in pollen gathering and nectar collecting. In Table I the index of flight activities during the various seasons is furnished. This is the material on which Graph I has been constructed. Since a swarm issued from colony C before 1st January 1938 and since the queen found in the hive after this date was missing before 13th January 1938 and had to be re-queened, the conditions in this colony are not, as has been stated earlier, strictly comparable with those of colony A or B. Indeed there is a remarkable fall in the activity of colony C particularly in the readings taken on and after 27th February 1938.

In the last three columns of Table I, the percentage of bees gathering pollen out of the total bees engaged in field work on any given day has been indicated. It is seen that in no case more than 40 per cent of the bees is engaged in pollen gathering. In about 18 readings, out of a total of 23, less than 20 per cent of the bees is engaged for this purpose. The percentage of bees gathering pollen on any given day in all the hives, appears to compare very favourably within the limits of the error that is obviously inescapable in a study of the present kind.

Over four times as many bees as are engaged during seasons of dull pollen activity are at work when there is an abundance of pollen. Thus the index of flights for pollen gathering on 29th January 1938 (a dull day) is 25 in colony A, but this is as much as 119 on 18th December 1937 (a busy day). On 20th November 1937 also there is a lull in pollen gathering and in colony B the index recorded on this day is only $\frac{1}{6}$th of that of the busiest day, viz., 18th December 1937. Similarly also in the case of nectar gathering, the readings taken on 1st January 1938 (the peak of activity) is nearly $4\frac{1}{2}$ times those taken on 29th August 1937 (a lull in nectar gathering). Whether these variations are merely due to the proximity of pasturage when bees can make a larger number of trips per day, or whether they are due to a larger number of field bees available in each colony on account of increased reproductive activity in the hive is hard to state definitely with the data available at present. Further work is necessary.

TABLE I. Index of Flight Activities.

Date of observation.	Hive A			Hive B			Hive C			Percentage of bees collecting pollen.			Remarks.
	Pollen.	Nectar.	Total.	Pollen.	Nectar.	Total.	Pollen.	Nectar.	Total.	A	B	C	
29—8—37	63	121	184	57	110	167	67	102	169	34	34	40	
18—9—37 and 19—9—37	60	130	190	54	105	159	65	153	218	31	34	30	
3—10—37 and 4—10—37	97	138	235	55	92	147	98	147	245	41	38	40	
22—10—37 and 23—10—37	32	173	205	33	190	223	23	183	206	15	15	18	
7—11—37	80	397	477	44	274	318	64	229	293	17	14	22	
20—11—37	25	380	405	15	274	289	20	342	362	6	5	6	Cold morning. Rain during previous night.
5—12—37	95	489	584	93	389	482	97	387	484	16	19	20	
18—12—37 and 19—12—37	119	481	600	95	420	515	102	372	474	20	18	22	
1—1—38 and 2—1—38	80	513	593	65	490	555	96	513	609	14	12	16	Swarm issued from colony C.
13—1—38 and 14—1—38	34	381	415	44	450	494	54	493	547	9	9	10	Queen missing in colony C and it was requeened.
29—1—38 and 30—1—38	25	435	460	25	460	485	35	580	615	5	5	5	
12—2—38 and 13—2—38	40	395	435	30	335	365	30	325	355	9	8	9	
27—2—38 and 28—2—38	75	320	395	35	230	265	25	180	205	11	13	12	
19—3—38 and 20—3—38	90	237	327	82	279	361	83	211	294	27	23	28	

Readings are not available for first week of April 1938.

Date of observation.	Hive A			Hive B			Hive C			Percentage of bees collecting pollen.			Remarks.
	Pollen.	Nectar.	Total.	Pollen.	Nectar.	Total.	Pollen.	Nectar.	Total.	A	B	C	
23—4—38 and 24—4—38	31	344	375	28	377	405	21	234	255	8	7	8	
7—5—38 and 8—5—38	25	430	455	31	442	473	11	239	250	6	7	4	
21—5—38 and 22—5—38	75	427	501	77	440	517	25	257	282	15	15	9	
9—6—38	56	225	281	49	323	372	28	170	198	20	13	14	
18—6—38	30	186	216	29	203	232	30	145	175	14	13	17	
8—7—38	38	58	96	31	58	89	37	73	110	40	35	34	Very cloudy weather.
23—7—38 and 24—7—38	48	242	290	46	271	317	32	172	204	17	15	16	
6—8—38 and 7—8—38	30	176	206	40	171	211	41	183	224	17	19	18	
20—8—38 and 21—8—38	31	283	314	30	283	313	33	200	233	10	9	14	Rain received on 21—8—38 afternoon.

Monthly variations. (*a*) *Pollen.* Pollen activity shows a remarkable increase between the end of November and end of December. It is during this period that there is considerable reproductive activity. A large army of field workers will be released by about December and the strength will be maintained at least till about the end of January. This is actually the case and we find in the graphs for nectar activity a remarkable and sustained peak during these months. The next season for pollen is during the month of March which is the forerunner of the honey crop of April.

In Table II the distribution of activity in percentages in respect of pollen activity during the various parts of the day is furnished. For the purposes of interpretation, it appears to be convenient to divide the day into three periods, viz., morning period from 6 to 10 a. m.; midday period from 11 a. m. to 2 p. m.; and afternoon period from 3 to 6 p. m. Although the number of readings that comprise each one of these periods is uneven, the number of full hours during which bees have been at work at each one of these periods does not vary considerably. In the absence of a better criterion for studying the distribution of flight activities during the day, this classification has been followed.

The total index for a day is taken as 100 and the distribution of activity during the three periods has been furnished in Table II. The absence of any material pollen activity after 2 p. m., is the most important feature of the Table. Of the 23 readings, only in one case 66 per cent. of the bees are seen to collect pollen between 3 and 6 p. m., and in three other cases about 33 to 40 per cent. In all other cases, less than 26 per cent. of the bees are active in collecting pollen. More than half of the readings show an activity ranging from 0 to 10 per cent. It is, therefore, reasonable to conclude that bees are not busy collecting pollen after 2 p. m. These observations are in conformity with those of Ratnam (1938a).

In respect of the distribution of pollen activity in the morning and midday periods, the year can be divided into two groups. From November to March, generally, over 50 per cent. of the bees are busy collecting pollen in the midday period. And in April to October bees are more active in the mornings.

The readings taken on 3rd and 4th October 1937 appear to be abnormal. This was perhaps due to some environmental factor other than pasturage conditions. What it exactly was has not been ascertained.

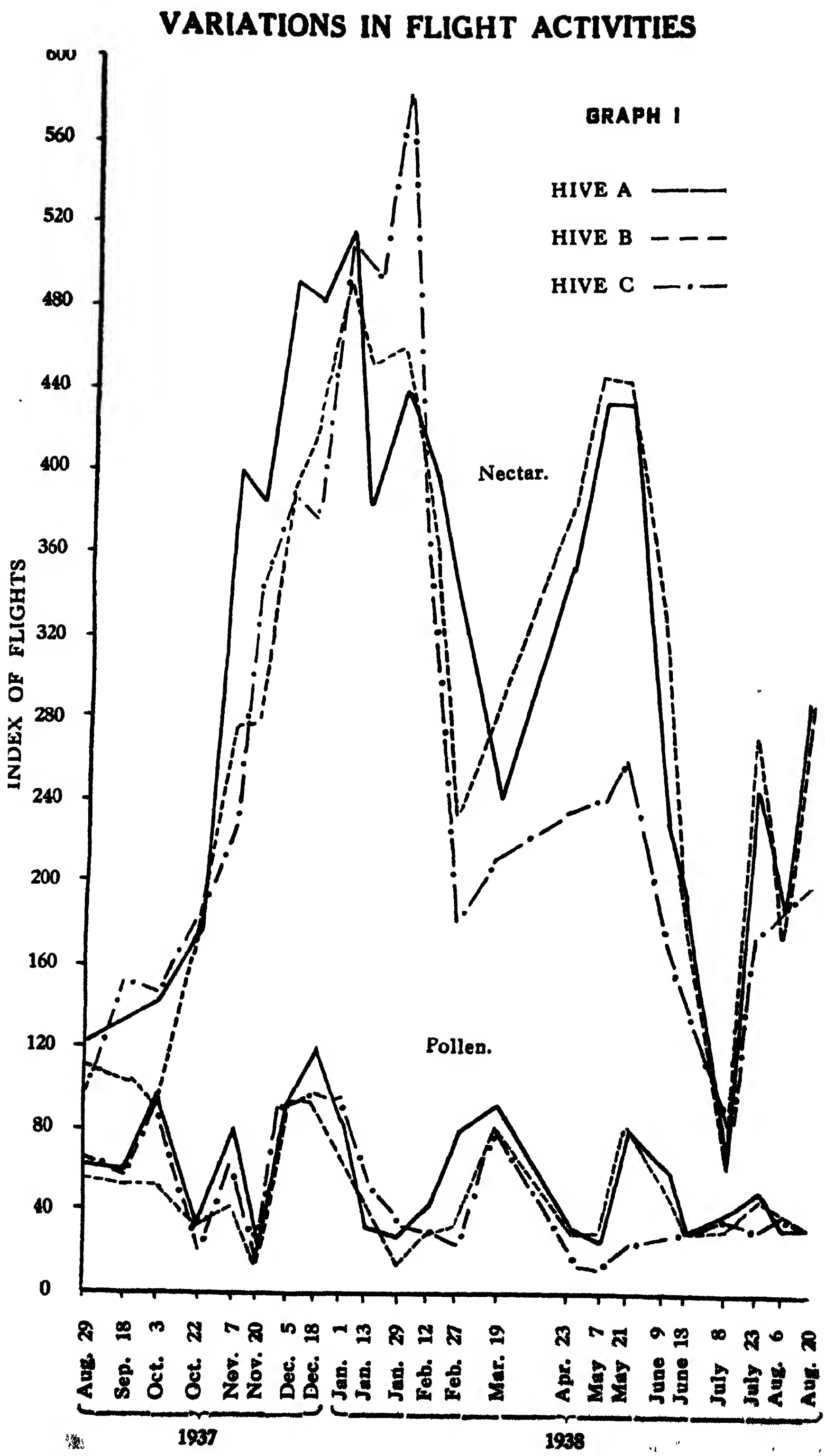
TABLE II. Distribution of flight activity during the day.

Hive A. (In percentages).

Date of observation.	Pollen gathering			Nectar gathering		
	6 a. m. to 10 a. m.	11 a. m. to 2 p. m.	3 p. m. to 6 p. m.	6 a. m. to 10 a. m.	11 a. m. to 2 p. m.	3 p. m. to 6 p. m.
29-8-37	67	33	...	28	53	19
18-9-37 and 19-9-37	88	12	...	39	46	15
3-10-37 and 4-10-37	20	14	66	25	25	50
22-10-37 and 23-10-37	97	3	...	72	16	12
7-11-37	50	35	15	37	43	20
20-11-37	4	92	4	36	51	13
5-12-37	64	32	4	23	57	20
18-12-37 and 19-12-37	31	54	15	20	55	25
1-1-38 and 2-1-38	67	24	9	17	58	25
13-1-38 and 14-1-38	12	50	38	12	63	25
29-1-38 and 30-1-38	16	48	36	12	58	30
12-2-38 and 13-2-38	40	52	8	21	48	31
27-2-38 and 28-2-38	36	47	17	22	31	47
19-3-38 and 20-3-38	29	70	1	49	33	18
Readings are not available for first week of April 1938.						
23-4-38 and 24-4-38	71	29	...	49	26	25
7-5-38 and 8-5-38	92	4	4	56	21	23
21-5-38 and 22-5-38	100	...	...	68	14	18
9-6-38	75	14	11	60	17	23
18-6-38	45	20	35	51	28	21
8-7-38	55	37	8	42	48	10
23-7-38 and 24-7-38	61	31	8	47	38	15
6-8-38 and 7-8-38	50	47	3	19	27	54
20-8-38 and 21 8-38	42	32	26	10	41	49

(*b*) *Nectar*. In Table II the distribution of nectar gathering during the day in percentages is given. As in the case of pollen collecting, bees seem to be less active in gathering nectar in the afternoons after 3 p. m. Of the 23 readings available as many as 17 readings show that 25 per cent. and less of bees are busy in gathering nectar after 3 p. m. Here again the readings recorded on 3rd October 1937 and 4th October 1937 appear to be abnormal.

In November to February bees appear to be busy at the midday period. During these months the morning activity appears to be even less than the afternoon activity. During May and June bees are most busy in gathering


VARIATIONS IN FLIGHT ACTIVITIES
GRAPH I
HIVE A
HIVE B
HIVE C
INDEX OF FLIGHTS
600
560
520
480
440
400
360
320
280
240
200
160
120
80
40
0
Nectar.
Pollen.
Aug. 29
Sep. 18
Oct. 3
Oct. 22
Nov. 7
Nov. 20
Dec. 5
Dec. 18
Jan. 1
Jan. 13
Jan. 29
Feb. 12
Feb. 27
Mar. 19
Apr. 23
May 7
May 21
June 9
June 13
July 8
July 23
Aug. 6
Aug. 20
1937
1938

nectar in the mornings. The activity is at its lowest during the midday period and slightly higher in the afternoons.

Generally it appears that the morning activity and midday activity are complimentary to each other. That is on days when the morning activity is high, the midday activity is low and *vice versa*.

The following variations in the average monthly nectar gathering activity are noticed :—

Trend of activity.	*Month.*
1. High midday activity	December, January, February
2. High forenoon activity falling only slowly as the day advances	November, April
3. High early morning activity with a steep fall after about 7 a. m.	May
4. High activity twice in the day at 6 a. m. and 6 p. m. with a lull during the midday	October
5. Peaks of activity thrice in the day :— (a) With the highest activity during midday	March
(b) With the highest activity during forenoon	June, July, September
(c) With the highest activity during afternoon	August

Discussion. The present investigation was undertaken to study seasonal variations in flight activity of bees and it has indicated the existence of wide fluctuations in their activities. In the two honey flow seasons the distribution of activity differs fundamentally. During November—January season the bees are more active during the midday but in April to June season the bees are extremely active during the forenoon only. The months of November and April mark the transition to very favourable pasturage conditions and the activities during these months are strikingly alike.

Practical bee-keepers recognize the supreme importance of maintaining strong colonies not only with a view to combat bee diseases and enemies but also with a view to obtaining the maximum honey crop during the honey flow seasons. For instance, during seasons of paucity of pollen, the reproductive activity in the hive is at its lowest ebb, and each colony dwindles very much in strength. During these unfavourable seasons the practical bee-keeper removes the supers and even a few brood combs, if necessary, so as to check ravages due especially to the wax moth. When there is a prospect of a nectar flow about a month or so ahead, the bee keeper tries to increase the strength of his colonies by artificial feeding and tries all his resources to prevent swarming at a later stage. Whether a graph of the type represented in Graph I can indicate impending changes in the environmental conditions so as to enable the bee-keeper to forestall requirements in respect of manipulations requires further study spread over a number of years.

As between hive and hive there is hardly any difference and where the reproductive activity within the hive is proceeding uninterrupted, the variations in flight activities in the respective hives are strictly comparable,

Summary and Conclusions. This paper embodies the results of a study relating to seasonal variation in flight activities of bees during the course of the twelve months of the year. Counts of bees arriving at the hive with or without pollen during a period of one minute taken at hourly intervals of a day and at intervals of a fortnight were made. Three hives were compared and no differences were noticed in the trends of activity in them. The activities during the day vary considerably in the various seasons. There are two honey flow seasons during the year during which the distribution of flight activities differs fundamentally. In November to January, midday activity is more pronounced but in April to June, bees are remarkably active in the forenoons. Variations of flight activities appear to indicate variations in pasturage conditions and so a knowledge of the former is, subject to further confirmation, considered as a satisfactory aid for determining practical manipulations required by the bee-keeper. Percentage of bees gathering pollen in each of the hives compares favourably with one another on any given day. The number of field trips made for pollen collecting on any given day is less than 20 per cent. of the total trips made. In seasons of high activity the total number of trips made exceeds four times those made in dull seasons.

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SELECTED ARTICLE

The storage of Tropical Fruits.

Of the number of attractive fruits native to tropical and sub-tropical regions, only a few have yet attained to commercial importance. Relative to citrus and bananas, all other tropical fruits, though their production could be greatly extended, occupy a very minor place on temperate markets and for the most part are only retailed in small quantities and at high prices for the delectation of connoisseurs.

In addition to the tropical fruits occasionally offered on temperate markets there still remains a very considerable number of exotic fruits whose overseas transport has not yet been attempted, or been taken beyond the preliminary experimental stages. For this seeming neglect many reasons can be advanced, including demand (which must first be created by an extensive advertising campaign), competition with other fruits chiefly temperate, difficulties of consistent production, the need for special packing, shipping and cold storage facilities and lastly, the high degree of wastage inseparable from the handling of delicate tropical fruits. With a few notable exceptions, in fact, the transport of tropical fruits is still in its infancy. With the improvement of transport facilities it may be anticipated that this situation will to some extent be modified and that, in time, an increased variety of properly ripened exotic fruits will regularly be offered on temperate markets. Accordingly a wide and interesting

field of scientific inquiry still awaits appropriate investigation. Relevant aspects, on which a brief annotation will be attempted here, include (i) horticultural relationships, (ii) harvesting maturity, (iii) pre-storage treatment, (iv) cold storage requirements, (v) post-storage and ripening treatments, and (vi) wastage.

1. **Horticultural Relationships** Environmental factors, seasonal conditions, and plantation sanitation are important in determining quality, keeping quality in storage and wastage (see below) The selection of varieties adapted to particular environments, and acceptable on distant markets, is of first importance. Some examples, illustrating these several points may be cited; avocados which possess a high fat content when grown under dry Californian conditions have a considerably diminished content when grown under humid conditions in Florida or the West Indies; the Peter's mango, which grows well under Jamaica conditions, cannot be grown commercially in Trinidad because of excessive rotting during storage; the Congo variety of banana, which is cultivated in the French Antilles and can be disposed of to advantage in French markets, is unacceptable on British or American markets.

Standardization and conservation of desirable types have also important economic aspects For example, in establishing grapefruit orchards, bud-wood should only be selected from trees known to possess consistently the desired degree of seedlessness. In fruits such as the papaw in which seedling types show great variability and where no method of vegetative propagation is known, the resulting absence of standardization is a serious obstacle in the way of developing an export industry.

2. **Harvesting Maturity.** The question of harvesting maturity is specific to each fruit, and criteria, not infrequently of an arbitary nature, have to be employed. To allow for the progress of ripening during transport and distribution, tropical fruits, as a rule, are picked somewhat immature. Thus the banana is reaped when it is still quite immature and green, at stages described as three quarters full, heavy three quarters full, or full, according to the distance of the market for which it is intended. The necessity for harvesting fruits somewhat immature adds to the problems of the physiologist, for whereas in some fruits the onset of ripening is indicated by well marked colour changes, in many others no colour change is apparent, and other means have to be devised in order that fruit shall be harvested at a constant maturity. With grapefruit and oranges biochemical tests based on the percentage of total solid, and on the ratio of sugar to acid have of necessity been adopted, particularly where early season's fruit is being handled. The ratios which have been found suitable in some countries, however, have not always proved rational or acceptable in others, and additional local criteria have had to be devised. In different varieties of mango, it has been found convenient to use a morphological criterion of maturity, the relationship between the stem insertion and the degree of development of the shoulders of the fruit (where growth is localized) being used for this purpose: otherwise, in many of the best commerical varieties colour changes associated with ripening afford very little assistance indeed. Again, in green varieties of avocado, no good criterion of commercial harvesting maturity, other than a tentative ratio of fat content to the fresh weight, has so far been ascertained. In fruits such as the papaw to illustrate another aspect of this problem, it has been found that unless fruits show some evidence of yellow (ripening) colour on harvesting, they will not ripen properly later. In tomatoes it is known that fruits picked when they show some pink coloration ripen to a product of superior quality than do those picked full grown but green.

3. **Pre-Storage Treatment.** As a rule, in handling tropical fruits, it is desirable that the time between reaping and placing them in cold storage should

be curtailed to the minimum, as it is during the period of exposure to tropical temparatures that fungi would make a rapid initial penetration which markedly affects the subsequent progress of rotting. Again, in fruits harvested just before the onset of ripening, undue exposure to high temperatures tends to accelerate maturation processes, thereby curtailing the anticipated storage life. While quick handling is usually desirable there are circumstances in which some delay is advisable. Thus with citrus fruits which have been picked in a highly turgid condition, it is sometimes advisable that a quailing or curing period should be allowed to minimize the tendency to superficial bruising and the concomitant fungal wastage.

In some industries, e. g., citrus, fruits may be subjected to routine washing, disinfecting, ethylene ripening and machine grading before being packed. Each process requires critical examination in respect of its physiological or pathological effect on the fruit, such problems as desiccation bruising and wastage being relevant to the case in point. Disinfectant treatments, for example, should only be used when the precise nature of the several rot-producing organisms has been clearly ascertained, since instances are known where the most important pathogens, being already present within the tissue as latent infections, or established as wound infections, are aggravated and not arrested or eliminated by the treatments applied.

4. **Cold Storage.** Although in some instances fruits may be shipped during comparatively long voyages without refrigeration, as a rule, particularly where delicate tropical fruits are concerned, cold storage is essential. Well-equipped refrigerated shipping is in fact the fundamental factor in the overseas transport of perishable tropical produce, refrigeration by the air blast system being now considered indispensable for the proper handling of fruit. For the major export commodities, such as bananas and citrus, considerable information on the required storage temperatures is now available, but for many others only fragmentary and inconclusive data have been obtained. In selecting a temperature for the overseas transport of fruits two factors are principally involved: (i) the temperature must be sufficiently low adequately to control or arrest ripening and the growth of pathogens, but (ii) it must not be so low as to cause physiological injury or "chilling" to the fruit. Fruits which have been chilled in transit not only fail to ripen properly, with concomitant loss of flavour, but they are also subject to increased fungal wastage The onset of chilling, in a number of fruits, is known to coincide with the onset of ripening - a critical phase in the life of fruits. Superficial chilling injury tends to be exaggerated where fruits are also subject to desiccation, whereas at high relative humidities such injuries may be more or less completely masked. Once the precise storage temperature, i. e., just above the critical temperature for chilling, has been ascertained, fruits may be cooled as quickly as possible by delivering cold air at that temperature, without danger of chilling. Where this information is available pre-cooling may be used to advantage.

The storage temperatures required by different tropical fruits cover a considerable range, which is, however, more in the nature of "cool" storage than "cold" storage. Thus, for fruit grown under West Indian conditions, the following temperatures have been determined: Limes, grapefruit and oranges, 45 F; tomatoes, 45–47F: avocados, 45F; mangoes, 47·5F; Lacatan Congo, Giant Governor bananas, 58F.; papaws 60F. In so far as chilling injury is in part a function of the duration of storage, fruits undergoing prolonged storage may require a modification in the upward direction, of the temperatures cited. The tomato may be cited as an example where fruits grown under different conditions may require considerably different storage temperatures. The banana

illustrates the fact that different varieties may show considerable differences in their tolerance of low temperatures. The range of temperatures required by different tropical fruits introduces additional difficulties in the matter of shipping, since, as a rule, even modern refrigerated ships are not provided with a number of small compartments in which small consignments can be accommodated each at its own special temperature.

The control of humidity, chiefly the maintenance of high humidities, is also important in the proper handling of fruits grown under moist tropical conditions. Instances are known (e. g., limes and grapefruit) where fruit may become unsightly and unmarketable, not because of the onset of fungal wastage, but on account of excessive desiccation. This aspect of the physiology of fruit in storage has so far received insufficient attention: with the advancement of special knowledge of the water-relations of fruit in storage considerable improvement in the technique of handling fruit should become a practical possibility.

5. Post-Storage and Ripening. When tropical fruits are removed from cold storage to higher temperatures, ripening takes place rapidly, and serious wastage may soon be sustained. To a considerable extent the latter undesirable feature could be overcome by hooding the fruit at a suitable temperature until required for actual consumption. In countries where refrigeration has been more or less thoroughly domesticated, such special post-transport treatment is feasible and is, in fact, a workable proposition. In many countries, however, refrigeration, whether in warehouse or small stores, is still regarded as an unwarranted and additional expense; until some modification is made in this point of view considerable wastage must be expected during the retailing of delicate tropical fruits. In brief, the outlook for exotic fruits on distant markets will be determined among other factors, by the extent to which the use of refrigeration becomes domesticated.

Some fruits, in particular the banana, undergo special ripening treatment, involving temperature and humidity control on being removed from the ships' holds: the improvement of ripening technique opens up a wide and useful field for physiological work.

6. Wastage. If tropical fruits are allowed to remain at high temperature for any considerable time after harvesting, the onset of wastage tends to be rapid. Hence recommendations for the improvement of shipments stress the importance of good organization to permit of expeditious handling after harvesting and rapid cooling to the approved storage temperature. Wastage in most instances may be attributed to the activities of two major types of pathogenic fungi: (i) wound parasites which enter through the numerous wound and abrasions sustained during handling; and (ii) those which are established as latent or dormant infections during the earlier stages of development of the fruit, and which do not become evident until a certain stage in senescence has been reached. Knowledge of the precise behaviour of the several organisms involved is essential in formulating rational measures of disease control. Thus where wastage is due to the development of latent infections, it is evident that control measures must be applied in the field (i. e. by protecting the young fruits from infection), and that questions of environment and plantation sanitation must be given consideration.

Summary. With a few notable exceptions, the overseas transport of tropical fruits is still comparatively undeveloped. The many factors involved in creating an export industry based on the production and handling of delicate fruits notoriously subject to wastage are briefly discussed and illustrated by reference to bananas, citrus, avocados, mangoes and papaws.

(*The Tropical Agriculturist*, Vol XCI, December 1938, No. 6.)

EXTRACTS

CASTOR OIL

The United States is easily the largest importer of Castor Beans and Oil, the bulk of her imports coming from British India. U. S. imports of Castor Beans alone for the year 1934-36 are as follows:—

Year.	Quantity thousands of lbs.	Total value thousands of $	Value per thousand lbs.
1934	92,840	1,738	18·72
1935	77,049	1,702	22·09
1936	164,077	3,621	22·07

Of the 164,077 thousand lbs. imported in 1936, the bulk came from British India. Other important producing countries are China, Japan, Brazil, Venezuela, and the Argentine.

Many of the producing countries manufacture their own oil, but it is claimed that the best extraction is at present done in the U. S. A.

Owing to the high oil content of the seed, Castor Oil extraction by pressure requires rather specialised machinery and solvent extraction methods are now the most popular.

The Castor Bean of commerce consists of (1) a soft non-fibrous kernel containing approx. 62·9% of oil (2) a thin brittle seed coat, easily cracked or chipped in handling, containing approx. 10% oil.

In handling the beans extreme care must be taken to prevent breaking of this seed coat and the elimination of such broken beans from the samples to be exported, as broken beans rapidly deteriorate, the oil being converted to glycerine and free fatty acid which causes the production of a highly coloured acid oil during the process of manufacture. In commercial practice an extraction of about 36% oil is obtained.

Uses of Oil. Owing to its very low freezing point (18°C) Castor Oil is used to a large extent for the lubrication of aeroplane engines. It also has the following advantages over mineral oils:—

a) Greater lubricating power.
b) Does not lose viscosity at high temperatures as quickly as mineral oils.
c) More penetrating, and
d) When mixed with gasolene, as happens during the lubrication of gas engines, it retains a higher viscosity than mineral oils.

Castor oil is also used for the lubrication of automobile engines. It is usually mixed with mineral oils, which are much improved thereby.

Mixed with animal fats in varying proportion it is also used for making various grades of grease for light and heavy lubricating work.

The uses of castor oil in medicine is well known.

Other uses of Castor Oil include:—

1) in manufacture of artificial leather.
2) leather lubrication.
3) assists penetration of tannin into leather.
4) production of Turkey Red dye.
5) manufacture of linoleum,
6) various uses in rubber industry.
7) manufacture of artificial skin preparations
manufacture of transparent soap.

9) manufacture of shellac.
10) manufacture of Typewriter ink.
11) manufacture of Flypaper.

The number of industrial uses of castor oil is undoubtedly expanding.

During the Great War the Allies devoted much attention to increasing the production of castor oil; as a result, on the cessation of hostilities, the world markets were to a great extent overstocked with this commodity. With the world again devoting itself to a policy of re-armament and the imminent threat of a major war staring us in the face, it is not unlikely that the demand for castor oil will soon be on the increase. *H. C. Cameron in the Journal of the Jamaica Agricultural Society* (1939), p. 25—26.

Gleanings.

Thorough Cultivation of Soil. In most countries, and especially in Great Britain, farmers have a traditional belief in the necessity and virtue of thorough cultivation. Although it is self-evident that some cultivation is needed to secure a satisfactory tilth, it is not certain that additional and deeper workings of the soil are as valuable as has been generally thought. At the present day when cultivation is one of the heaviest expenses on the farm, the question clearly needs reconsideration, and Dr. B. A Keen has recently given some interesting results of investigations on the subject (*J. Min. Agric.*, 45, 645; 1938). Experiments carried out over a number of years on heavy land showed that deep ploughing or subsoiling was of little or no benefit to a sugar beet crop, while extra ploughings, though they produced some small increase in the yield of the potatoes and sugar beet, were also uneconomic operations Similarly, intensive inter-row cultivation of root crops, hitherto regarded as desirable, proved a waste of labour on both heavy and light land The practice of rolling and harrowing cereals, on the other hand, was supported by experimental evidence. Rotary cultivation received special attention, comparison being made between plots prepared by the plough, the grubber and the rototiller. Germination tended to be quicker on the loose seed bed from the rototiller, but subsequent growth and yield were very similar on all three sets of plots. If time presses, therefore, the quicker and cheaper process of grubbing can safely be substituted for ploughing, but the practice should not be continued for several years in succession, as weeds are liable to increase rapidly. The conclusion that, beyond a certain minimum, cultivation has little influence on crop yield has also been reached from experiments carried out on different soil and under different climatic conditions, but still further work is needed to determine if the results are of general application, or are typical of certain types of soil and climate only. (*Nature*, Vol. 143, No. 3610)

All Flesh is Grass. It is remarkable how important grass is to us all. When we come to think of it, grass is the foundation of both human and animal life. The meat eating animals certainly don't feed on grass, but without grass to fatten other animals they would die. Grass is the basis of all life on the land. It is the basis of all Agriculture. Without grass man would soon perish from the earth. Looked at in that light, pasture renovation and management becomes really an expression of a natural instinct of self-preservation. (*Queensland Agri. Journal*, Vol. LI. Part 3.)

Moving with the times To-day brains and education were never more needed to run a farm successfully. A knowledge of science—that is, the science that any level-headed farmer can acquire—ought if directed properly, to put in enhanced value on our practical work. A little more study of the scientific side

would help to lighten the drudgery now so much associated with the lives of many producers. Farm science with a reasonable amount of practical knowledge is the strongest sort of combination that could be applied to the task of getting the most and best out of a farm. Of course, we all know the farmer who says that he hasn't got time to waste on reading up what is new. But it is a good policy, and it pays to find out what other farmers are doing and what research workers are finding out, and what general progress is being made in the industry. Farmers, like everyone else, can't afford to stay in one place. We have to move with the times and make use of the latest knowledge and gadgets if we are to get what we should get from our land. (*Queensland Agri. Journal* Vol. LI. Part 3.)

Rubbered Wool Yarns. The Wool Industries Research Association in its annual reports for 1936—1937 makes mention of successful experiments in the rubber treatment of wool yarns. It is possible, according to the association's report, to rubberise wool yarns in hank form with a suitably prepared latex without any matting. The wool can be dyed either before or after treatment, and the colour may be applied, if so desired, in the latex itself. The process is expected to give favourable results in the manufacture of strong yarns with little twists, and of felt. It is also recommended for special purposes, such as water-resistant or mothproof fabrics :— (*Tropical Agriculture*, Vol. XVI, No. 4)

Jute Substitutes. According to the information contained in the Bulletins of the Indian Central Jute Committee, a new Italian company has been floated in Ethiopia with the object of cultivating fibres which can serve as substitutes for jute in East Africa.

The Department of Agriculture South Africa, has been experimenting for some years with Brown Hemp, or *Hibiscus canabinus* indigenous to South Africa, and has come to the conclusion that this annual, which often reaches a height of seven feet, can be cultivated on a wide scale and used as a substitute for jute. *Hibiscus bifurcatus*, a native plant of Brazil, has been found to be useful as a substitute for jute in that country.

A new type of heavy paper suitable for the manufacture of sacks has been made by Dr. Tunji Torii, Chief Chemist of the Japanese Bag Company, Tokyo. The product is reported to be better than hemp or leather, in resisting water and sand, and it is claimed that its strength increases when left in water for prolonged periods. In Manchukuo, Kenaf is being cultivated on a large scale with a view to substituting it eventually for jute.

In the Belgian Congo, *Urena Lobata* and *Punga* fibres, which were introduced in 1930, have achieved a position of relative importance as substitutes for jute.

Rosella is being cultivated in Java, and Rosella bags are being extensively employed in the sugar trade in place of jute bags. It is expected that unless unforeseen circumstances arise, Java will become self-supporting in three to four years at least so far as sugar bags are concerned. (*Tropical Agriculture*, Vol. XVI. No. 4.)

Absorption of growth promoting substances by cuttings. About two years ago a batch of leafless cuttings of *Bougaivillea* (var *Mrs. Louis Walthen*) was received at these laboratories for propagation. They were planted in our usual propagators. The majority threw out small shoots but there was no callussing or root development. After eighteen months it was decided to try the effect of a proprietary root growth-promoting substance. The cuttings still alive were treated in the normal way, that is, by immersion of the basal ends in a dilute solution for eighteen hours. However, no callussing or rooting took place and it is assumed that this was due to lack of transpiration in the cuttings, which were leafless when treated.

Finally it was decided to try the effect of forcing the growth-promoting substance into the cuttings now almost exhausted of food reserves. The ends of the cuttings were cut off to expose fresh surfaces. The lower ends were submerged to a depth of one inch in the solution contained in a vacuum desiccator which was exhausted until a strong stream of bubbles emerged from the bottom end of each cutting. On breaking the vacuum the solution was forced into the submerged ends. Two or three months after replanting the cuttings, 90 per cent. rooted and are now healthy plants.

The experiment was not planned as a test of the growth promoting substance but was made in a final attempt to save the last remaining cuttings of a variety new to Kenya. So stricking have been the results that the suggestion is put forward that possibly failure to secure rooting with winter cuttings of deciduous plants after treatment with various growth-promoting substances has been due to non-absorption, or to the absorption of too little of the material by the leafless cuttings. (*Tropical Agriculture*, Vol. XVI, No. 4.)

Agricultural Jottings

(From the Director of Agriculture, Madras)

POSSIBILITY OF SILAGE MAKING ON THE WEST COAST

Cattle form the back bone of Agriculture in the West Coast as in other parts of India. But one has to feel shy of the extremely poor and impoverished condition of the animals, that are kept on the West Coast. There may be several reasons for the poor condition of the cattle in this district, but one prominent reason is under-feeding especially in the growing stages. The statement that fodder is scarce in the West Coast in spite of the abundant growth of green grass during the monsoon months and the large area under paddy may seem a paradox. The first crop harvest of paddy coincides with the monsoon and very little straw of this season can be dried and stored for the cattle. The second crop gives much better straw but most of it is sold away for thatching purposes. Thus very little straw is available for fodder. Growing of fodder crops for summer months is not also an easy affair owing to the paucity of irrigation facilities. The only alternative therefore is to preserve the profuse growth of grass that grows, as the result of the heavy monsoon rains.

West Coast is blessed with abundant rainfall from May to November and green grass springs up everywhere in plenty but part of the grass is cut and used for thatching while the rest is allowed to dry up instead of being converted into valuable fodder. If only cultivators, who own cattle, care to cut and preserve grass available at the close of the monsoon, all the starving animals on the West Coast could be properly fed and their condition improved. The process of preserving green grass is simple and can be easily adopted by any one. The Madras Agricultural Department has issued a Leaflet (No. 7 of 1930) giving full details of the process of silage making and may be of use to those who intend to make silage.

With the cessation of the North-East Monsoon rains in the month of November the paddy cultivator is practically idle and the cultivator can profitably utilise his leisure for this operation. Silage pits of convenient size 15′ × 10′ × 8′ can be easily dug in high level places without the necessity of retaining walls. Grass of good quality can be had in plenty during this time and can be even purchased very cheap. Layer by layer the grass has to be spread in the pits, compressing it every time to exclude air. Where they are full they are finally mud plastered for the purpose of excluding air, as well as compacting the material. The grass so preserved undergoes certain changes in the pit and will be

ready for utilisation as cattle feed within about 2 to 3 months. This preserved grass is commonly known as 'Silage'. Silage is almost as good as green fodder. It is true that cattle do not relish it when it is first offered to them on account of the smell. This difficulty can however be easily got over if in the early stages the silage is mixed up with straw and fed in small quantities. Later on the animals will eat it with great avidity.

The economic side of the question has been worked out at the Agricultural Research Station, Pattambi, and the figures obtained reveal that 100 lb. of good silage can be made at a cost of Re. 0—2—8 to 0—3—0. During the years 1936-37 and 1937—38, 1,08,760 and 72,965 pounds of green grass were respectively purchased at 0—1—8 per 100 pounds and ensilaged. The total cost of grass and converting it into silage worked out to Rs. 119—10—4 and Rs. 30—3—6 in 1936—37 and Rs. 70—2—0 and Rs. 27—8—0 in 1937—38 respectively. The silage obtained during 1936—37 amounted to 74538 pounds enough for 7 pairs of animals for 5 months when fed on this alone. At the Agricultural Research Station, Pattambi this quantity was enough for 30 heads of animals supplemented with straw.

Thus there is immense possibility for the West Coast farmers to improve their live-stock by preparing silage and adequately feeding them during the summer months. The animals at the Agricultural Research Station, Pattambi, were purchased locally and their present condition will show how far local poor animals could be maintained in good condition by proper feeding and care.

The nearest Agricultural Demonstrator, will be ever ready to help such of those who contemplate silage making.

Correspondence.

To

The Editor, Madras Agricultural Journal.

Sir,

In the note on "bamboos in flower" under "Correspondence" by Sri. K. Varadachari in the April issue of your Journal two points have been raised; 1. Whether the flowering has been observed in other parts of the Presidency and 2, how and why the flowering is forced up in times of drought. I propose to offer some explanation for the latter.

When I was touring in Malabar some years ago I met with a *Careya arborea*, Roxb. (Tam: *Ayma*; Mal: *Perzhu)* tree in flower which was about a couple of months ahead of the usual flowering time of this species. When examined, the tree was found to have been cut for more than half its width at the base and was left without felling. Owing to this condition, the normal metabolic process of the plant was seriously upset and the plant was not able to take sufficient water for transpiration. Due to this diminished supply of water containing salts, the ratio between the carbo-hydrate content of the plant and the salts in water is upset and as a result the plant flowers for the reproduction of the species. Similarly in the case of bamboos, whenever there is insufficient water for transpiration due to prolonged severe drought condition, the plants hasten to flower.

Madras Herbarium,
Coimbatore,
15th May 1939.

(S.) K. Cherian Jacob.

To

The Editor, Madras Agricultural Journal.

Dear Sir,

The two replies published in the March Journal approve of the idea of propaganda through songs. This was recognised early enough by the officers of the Agricultural Department and as a result we have now a few songs published in the form of leaflets. The authors of the two replies have stressed the necessity for talkie films in preference to mere gramophone records. This also is accepted as good in principle and some preliminary correspondence took place about the Department possessing a few such films. Due, probably to lack of funds this proposal has not materialised yet and let us hope it would materialise soon.

In the mean time there is definitely a place and need for the gramophone records suggested. The essential feature about the original suggestion is that it does not involve any financial implications. Efforts are to be made to get good records made. The songs must be sung by first rate artistes. A timely word now and then in responsible quarters from eminent persons (e. g. the ministers) would do the trick. We would then hear the agricultural songs in all sorts of odd places. That would by itself be a long step forward in propaganda. The next stage would come, when funds are available to provide the Agricultural Demonstrators with records and machines as a part of the propaganda equipment for use in the villages. The success of this venture will lead eventually to the production and exhibition of Agricultural talkie films.

The most essential point about this system would be that the songs must be sung by the popular first-rate artistes.

Coimbatore,
14—4—39.

V. Satagopan,
Agricultural Demonstrator.

To

The Editor, Madras Agricultural Journal.

Cereus Pterogonus as a source of pollen for bees.

Sir,

The plant which was designated as *Pachycereus marginatus* in the Madras Agricultural Journal 1938 *26*: 17-26 and as *Cereus Peruvianus* (?) in the Madras Agricultural Journal 1938, *26*: 421-433 has now been correctly determined as *Cereus Pterogonus*, Lem. The latter name, therefore, has to be substituted wherever the former names occur.

Coimbatore,
17th April, 1939

R Ratnam.

Indian Central Cotton Committee.

[We have received the following Press Communique for publication
—*Ed. M. A J.*]

The problems connected with the present position of cotton and the measures for dealing with them formed the principal subject of discussion at the meeting of the Indian Central Cotton Committee held on the 31st March 1939 under the Chairmanship of Sir Bryce Burt, Vice-Chairman of the Imperial Council of Agricultural Research and President of the Indian Central Cotton Committee. The Special Sub-Committee which was appointed to examine the matter from all aspects met on March 27th and 28th under the Chairmanship of Sir Chunilal Mehta, Vice-President of the Committee, and its report and

recommendations, which covered the following points, served as the basis of discussion at the main Committee:—

1. The need for securing a better balanced production of different cottons.
2. Raising the efficiency of cotton cultivation.
3. Restriction of cotton cultivation on marginal lands.
4. Finding of alternative uses for short staple cotton.
5. Intensification of efforts to check malpractices and improvement of marketing to ensure that cottons reach spinners in pure condition to enable their being put to optimum use.
6. Import duty on foreign cotton.
7. Reduction in railway freight rates on cotton.
8. Enhancement of import duty on rayon yarn.
9. Division of areas into zones for growing long, medium and short staple cottons.
10. Provision of proper hedging facilities for staple cottons.
11. Proposed conference of main cotton growing countries to regulate production and export.

In connection with the need for securing better balanced production of different cottons, the Committee expressed the view that, while satisfactory progress in the matter of replacement of short staple cotton by long had been made during the past few years, further investigations appeared necessary, and the process of better balancing of short and long staple cottons in India should continue. With this object it was suggested that efforts should be made to obtain fresh breeding material showing variability and combining resistance to drought and disease with good ginning percentage, lint length etc.; from all possible sources including foreign countries, for trial in various tracts. It was stressed, however, that the advantage of the change to the cultivator should, at no stage, be overlooked, and that due consideration should continually be given to what would be the most paying type for him to grow in the long run.

In order to raise the efficiency of cotton cultivation, the starting in major cotton growing tracts of cotton cultivation projects on complete holdings, or preferably in villages, managed and cultivated by the cultivators themselves according to the best system advised by the local agricultural department, and where the results of research work could be concentrated in practice and demonstrated to growers under cultivators' conditions with the improved type or types of cotton best suited to each tract was recommended. Such work, it was suggested, should be carried out by Provincial Departments of Agriculture in collaboration with the Committee in selected holdings or villages.

The curtailment of acreage in India as a means of raising the price of cotton was considered to be of doubtful advantage, but it was decided that if an international conference were held with the object of restricting cotton production, India should be represented at it.

The Committee reiterated its view, expressed on previous occasions, that there should be no relaxation of efforts to reduce mixing and other malpractices which prevented certain Indian cottons from being used to the best advantage and which adversely affected the cultivator. The application of the Cotton Transport Act, the Cotton Control Act and the Cotton Ginning and Pressing Factories Act, wherever possible, was advocated. It was emphasised that an important seed scheme in Sind was being held up as one of the conditions for the grant laid down by the Committee, viz., the application of the Cotton Ginning and Pressing Factories (Bombay Amendment) Act to the Province, had not been given effect to.

Considerable discussion centred round the recent increase in import duty on foreign cotton and the following two resolutions were passed, the second by a majority of 26 to 6.

1. " The Indian Central Cotton Committee desires to place it on record that it has not recommended an increase in the duty on all foreign cotton. It reiterates the view expressed in 1937 and 1938 that should the parity of Indian and imported cotton move to a point justifying such action, the import duty should be increased on all cottons which compete with Indian cotton, i. e., cottons below 1" staple at present ".

2. " The Indian Central Cotton Committee is of the opinion that the recent increase in import duty on foreign cotton to be effective in helping the production of long staple cotton in India should have been accompanied by restriction on the import of foreign yarn and cloth or a corresponding increase in duty on such imports ".

The report that the U. S. A. intended granting an export bounty on American cotton was also considered by the Committee and the following resolution submitted to it by the Wider Markets Sub-Committee was adopted :—

"In view of the news received recently to the effect that U. S. A. intend granting an export subsidy for American cotton to the extent of 1·25 to 2 cents per lb. of cotton exported from the U. S. A., this Committee recommends that the Indian Central Cotton Committee should consider without delay the necessity of the indigenous cotton market being preserved for Indian cotton by urging the Government of India to adequately raise import duties on subsidised cotton, cotton cloth and yarn in such effective manner as will prevent cloth and yarn made out of bounty-fed American cotton from replacing manufactures of Indian cotton, and to take such other effective steps in consultation with the Indian Central Cotton Committee as may appear feasible ".

In regard to the provision of better hedging facilities for staple cottons, a special Sub-Committee was appointed to consider and report on the suggestions made for the widening of the Broach Hedge Contract and the Karachi 4F Contract, for the establishment of a separate contract for staple cottons and for trading to be permitted in the Broach Contract in new crops a year ahead.

Subject to examination of final details by the Standing Finance Sub-Committee, the Committee approved of the recommendation of the Technological Research Sub-Committee for the purchase of a pilot plant for determining the cost of production of chemical cotton from linters, waste and cheap cotton. Sanction was also provisionally accorded to a scheme for carrying out investigations at the Technological Laboratory for improving the ginning of Indian cottons involving an estimated non-recurring expenditure of Rs. 24,500 and a recurring charge of Rs. 4,600 per annum.

A new cotton breeding scheme for the production of long staple cotton for cultivation in Sind at a total cost of Rs. 2,23,70 over a period of 5 years was also provisionally sanctioned.

Before the proceedings of the meeting terminated, the Committee placed on record its appreciation of the valuable service rendered by Sir Bryce Burt during the past 18 years of his association with it, first as Secretary, then as Member and finally as its President. It expressed the view that the success of the work of the Committee could in large measure be said to be due to his advice, guidance and close attention to problems connected with cotton development.

Crop & Trade Reports.

Cotton—1938-39—fifth or final report. The average of the areas under cotton in the Madras Province during the five years ending 1936-37 has represented 9·6 per cent of the total area under cotton in India.

The area under cotton in the Madras Province in 1938-39 is estimated at 1,957,600 acres as against 2,556,100 acres for the corresponding period of last year and 1,873,900 acres according to the forecast report issued in February. The present estimate for Province represents a decrease of 23·9 per cent as compared with the finally recorded area of 2,572.024 acres in 1937—38. The final estimate of last year fell short of the actuals by 0·6 per cent.

The decrease in area in the current year as compared with the area in 1937-38 occurs in all the important cotton growing districts of the Province and is attributable largely to unfavourable seasonal conditions.

Picking of cotton is in progress and may be finished in about a month.

Normal yield is expected in Kurnool, Anantapur, Madura, Ramnad (unirrigated cotton), Tinnevelly (Tinnevellies cotton) and South Kanara. A yield below normal is expected in the other districts mainly owing to drought. The estimated yield is lowest in Coimbatore (55 per cent for dry Karunganni and 60 per cent for irrigated Karunganni, dry Uppam, Nadam and Bourbon). In East Godavari, the crop was damaged by the cyclone in November and the yield is therefore estimated at only 70 per cent of the normal.

The seasonal factor for the Province as a whole works out to 86 per cent of the average for irrigated cotton and 95 per cent for unirrigated cotton, the corresponding figures according to the Season and Crop Report of last year being 94 per cent and 85 per cent respectively. On this basis, the yield works out to 388,900 bales of 400 lb. lint as againt 504,510 bales of last year which represents a decrease of 22·9 per cent. The yield in an average year is estimated at 506,570 bales. It is, however, too early to estimate the yield with accuracy as much will depend on future weather conditions and their effect on the second crop and on the amount of damage done by insect pests.

The estimated area and yield under the several varieties are given below :—

(Area in hundreds of acres, i. e., 00 being omitted ; yield in hundreds of bales of 400 lb. lint, i. e., 00 being omitted.)

Variety.	Area.		Corresponding yield.	
	1938--39. Acs.	1937—38. Acs.	1938—39. Bales.	1937—38. Bales.
(1)	(2)	(3)	(4)	(5)
Irrigated Cambodia ...	152,0	264,8	82,0	159,9
Dry Cambodia ...	187,9	312,4	35,6	63,4
Total, Cambodia ...	339,9	577,2	117,6	223,3
Karunganni in Coimbatore	62,0	142,0	7,7	28,9
Uppam in the Central districts.	20,1	34,9	2,8	5,2
Nadam and Bourbon ...	3,3	25,2	2	1,1
Total, Salems	85,4	202,1	10,7	35,2

Tinnevellies*	...	513,2	547,5	132,2	134,0
Northerns and Westerns	...	890,0	1,091,0	107,8	89,7
Cocanadas	...	123,3	131,3	19,9	22,2
Others	...	5,8	7,0	7	8
Province	...	1,957,6	2,555,1	388,9	505,2

* Includes Uppam, Karunganni and mixed country cotton in the south.

The table below gives final information so far as it is available on the crop of 1937—38:—

(Figures in hundreds of bales of 400 lb. lint, i. e, 00 being omitted.)

Particulars.	South. Tinnevellies and Salems.	South. Cambodia.	Deccan, Northerns and Westerns.	Rest of the Province Cocanadas and others.	Total.
(1)	(2) Bales.	(3) Bales.	(4) Bales.	(5) Bales.	(6) Bales.
1. Pressed at presses and loose cotton received at mills in 1938—39.	164,7	249,0	106,5	32,3	552,5
2. Add estimates of extra factory consumption.	6,0	Nil.	6,0	4,0	16,0
3. Total crop of 1937-38.	170,7	249,0	112,5	36,3	568,5
4. Yield as estimated in April 1938.	169,2	223,3	89,7	23,0	505,2
5. Yield as estimated in the Season and Crop Report.	187,8	213,6	81,1	22,0	504,5

Note—(1) *Item* 1. The entries mainly relate to the crop of 1937—38. The early sown crop in the Deccan, however, generally comes into the market from December in each year. The figures are taken from the weekly returns furnished by mills and presses.

(2) *Item* 2. The figures are approximate.

(3) Figures of carry over of crop are not available nor are figures of arrivals and despatches by road of the different varieties available.

7. The average wholesale price of cotton lint per imperial maund of 82-2/7 lb. as reported from important markets on 11th April 1939 was Rs. 14—5—0 for Cocanadas, Rs. 14-3—0 for Red-Northerns, Rs. 13—2—0 for White Northerns. Rs. 11—10—0 for Westerns (Mungari crop), Rs. 14—3—0 for Westerns (jowari crop), Rs. 25—4—0 for Coimbatore, Cambodia, Rupees 19—14—0 for Southern Cambodia, Rs. 21—9—0 for Coimbatore-Karunganni, Rs. 19 for Tinnevelly-Karunganni, Rs. 18—2—0 for Tinnevellies, and Rs. 17—14—0 for Nadam cotton. When compared with the prices published in the last report, i. e., those which prevailed on 6th February 1939, these prices reveal a rise of about 6 per cent in the case of Tinnevellies, 5 per cent in the case of Southern-Cambodia and Westerns (jowari crop), and one per cent in the case of Coimbatore-Cambodia and Tinnevelly-Karunganni and a fall of 5 per cent in the case of Cocanadas, 4 per cent in the case of Red-Northerns, 3 per cent in the case of Westerns (Mungari crop), and 2 per cent in the case of White Northerns, the prices of Coimbatore-Karunganni and Nadam cotton remaining stationary or practically stationary. *(From the Director of Industries and Commerce).*

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 19th May 1939 amounted to 202,356 bales of 400 lb. lint as against an estimate of 3,88,900 bales of the total crop of 1938-39. The receipts in the corresponding period of the previous year were 177,449 bales. 164,536 bales mainly of pressed cotton were received at spinning mills and 56,282 bales were exported by sea while 79,167 bales were imported by sea mainly from Karachi, Egypt and Bombay.

(From the Director of Agriculture, Madras).

College News & Notes.

Students' Corner. The practical examinations for the B. Sc. Ag. Degree in Agriculture came to a close on the 1st of this month. The results of the University Examinations are published elsewhere in this number.

Personal. We are glad to note that Sri. P. Uttaman, B. Sc. Ag., M. Sc., Assistant to Paddy Specialist, Pattambi, has been offered and accepted the post of first Research Assistant in Paddy under the Government of Orissa.

Visitors. Sri. Rao Bahadur M. R. Ramaswami Sivan, Retired Principal, Agricultural College, has been here in the Estate for over a month now on a short holiday.

A party of health officers under the leadership of Dr. Akroyd of the Nutritional Research Laboratories, Coonoor, visited the College and Research Institute on the 23rd May.

Officers' Club. In the Presidency Auction and Contract Bridge tournament conducted under the auspices of the Cosmopolitan Club, Coimbatore, the following members of the officers' Club came out successful.

Contract Bridge. Winners : T. S. Ramasubramania Ayyar and M. S. Kylasam.
Runners up : M. A. Sankara Ayyar and C. S. Krishnaswami.

Progressive Contract Bridge. North-south winners :
M. S. Kylasam and T. S. Ramasubramania Ayyar.

Fodder and Grazing Committee. We are glad that Mr. Cherian Jacob has been nominated by the Government of Madras as a member of the Special Fodder and Grazing Committee, constituted in pursuance of the recommendations of the preliminary committee of Forest Officers which the Government of India appointed in 1936 to advise the Animal Husbandry wing of the Board of Agriculture and Animal Husbandry in the matter of better utilization of the forest areas for grazing.

The function of the Provincial Committee is to investigate the re-classification of waste land outside Government forest and select areas fit for the production of fodder or for management as grazing grounds. The Committee is also to advise the Government as to the best agency for management of lands selected for fodder and grazing purposes and is to indicate the lines along which investigations are needed and improvements in management are required.

Entomological Society of India—S. India Branch. Sri. T. V. Subramaniam, Secretary, S. Indian Branch of the Entomological Society of India, writes to us under date Coimbatore, the 15th May 1939.

" A meeting of the Entomological workers resident in Coimbatore, was held on 3rd May 1939 at the Laboratory of the Government Entomologist, Agricultural College and Research Institute, presided over by Sri. M. C. Cherian. A South Indian Branch of the Entomological Society of India with headquarters at Coimbatore was formed with Sri. M. C. Cherian as President and Sri T. V. Subramaniam as Secretary,"

The late Rajagopal. G. Mal.

It is with deep regret that we have to record the sad demise, on 21-3-39, following an attack of pulmonary tuberculosis of Rajagopal G. Mal, L. Ag. Agricultural Demonstrator, Nanguneri, at the age of fifty. A good sportsman, he braved the difficulties and disappointments that fell to his lot; but, was no match to the cruel disease to which he succumbed.

We offer our sincere condolence to the bereaved family.

Weather Review—APRIL 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·0	-0·8	1·4
	Calingapatam	0·5	-0·4	0·9
	Vizagapatam	0·0	-0·7	2·7
	Anakapalli*	0·0	-1·3	1·7
	Samalkota*			
	Maruteru*	0·2	-0·6	1·4
	Cocanada	0·5	-0·1	2·7
	Masulipatam	0·1	-0·5	0·5
	Guntur*	0·4	-0·3	0·9
Ceded Dists.	Kurnool	0·6	0·0	0·6
	Nandyal*	0·3	-0·7	0·4
	Hagari*	0·4	-0·6	0·4
	Siruguppa*	0·1	-1·0	0·2
	Bellary	1·3	+0·5	1·3
	Anantapur	2·5	+2·0	2·5
	Rentachintala	0·4	...	1·4
	Cuddapah	1·2	+0·7	1·7
	Anantharaju-pet*	5·7	+1·5	9·2
Carnatic	Nellore	2·9	+2·5	4·0
	Madras	5·2	+4·7	6·2
	Palur*	8·4	+6·2	11·7
	Tindivanam*	4·5	+3·6	6·2
	Cuddalore	9·9	+9·3	13·7
Central	Vellore	5·4	+4·4	7·6
	Salem	5·7	+3·9	7·2
	Coimbatore	1·3	-0·1	4·0
	Coimbatore A. C. & R. I.*	1·1	-0·8	3·7
	Trichinopoly	5·6	+3·9	7·5

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	11·3	+10·7	12·9
	Aduthurai*	10·3	+9·5	13·0
	Madura	7·1	+5·0	9·7
	Pamban	2·2	+0·6	5·5
	Koilpatti*	2·6	-0·5	5·4
	Palamkottah	1·0	-1·5	4·0
West Coast	Trivandrum	6·7	+2·2	8·1
	Cochin	11·3	+6·6	13·6
	Calicut	6·9	+3·6	7·0
	Pattambi*	6·9	+3·4	8·0
	Taliparamba*			
	Kasargode*	3·7	+1·2	3·7
	Nileshwar*	2·5	+0·7	2·5
	Mangalore	5·0	+3·7	5·0
Mysore and Coorg	Chitaldrug	4·7	+3·7	4·7
	Bangalore	6·1	+4·8	7·1
	Mysore	2·1	-0·3	3·2
	Mercara	1·4	-1·2	2·4
Hills	Kodaikanal	5·7	+1·4	15·1
	Coonoor			
	Ootacamund*	3·2	-0·6	5·5
	Nanjanad*	1·8	-1·4	4·4

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette.

The unsettled conditions in the south Bay of Bengal on the 12th developed into a depression on the 13th, intensified into a storm on the 14th and after causing fairly wide-spread rainfall in South East Madras, South of the Presidency and the West Coast, moved away on the 18th. Rainfall was in large excess all

over the Presidency with the exception of the Circars and West Deccan. Skies were moderately to heavily clouded The humidity was in defect in parts of South East Madras and North Madras coast. Maximum and minimum temperatures were below normal. Rentachintala recorded a maximum of 110°F on the 30th.

Chief amounts of rainfall.

Negapatam	5·5" on 13th.
Chidambaram	6·1" on 16th.
Cochin	5·1" on 14th.
Tirukoilur	5·1" on 16th.

Weather Report of the Agricultural College & Research Institute Observatory.

Report No. 4/39.

Absolute maximum in shade	...	99·5°F
Absolute minimum in shade	...	63 8°F
Mean maximum in shade	...	94·4°F
Departure from normal	...	-1·2°F
Mean minimum in shade	...	72·0°F
Departure from normal	...	-1·1°F
Total rainfall for the month	...	1·1"
Departure from normal	...	-0·8
Heaviest fall in 24 hours	...	0·6"
Number of rainy days	...	2
Mean daily wind velocity	...	2·3 m. p. h.
Departure from normal	...	-0·3
Mean humidity at 8 hours	...	73·5
Departure from normal	...	+2·4

Summary. But for the local thundershowers on the 8th, 14th, 16th and 23rd, the month was practically dry. Skies were moderately to heavily clouded and the humidity was largely in excess. The mean maximum, the mean minimum and the rainfall were all in defect. P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notification.

Transfers.

Name of officers.	From	To
Sri K. Raghava Achariya,	Asst D. A. Cuddalore,	Asst. D. A., Cuddapah.
,, R. Swami Rao,	Asst D. A. Cuddapah,	Asst. D. A. Cuddalore.

Subordinate Services.

1. Transfers.

Name of officers.	From	To
Sri. P. Gopalakrishnan,	F. M., A. R. S., Nanjanad,	Offg. F. M., A. R. S., Koilpatti.
,, A. Subba Rao,	Off. F. M. A. R. S. Kodur.	A. D., Siruguppa.
,, K. Krishna Hegde,	A. A. D., Kasargode.	Govt. Botanical Gardens, Ootacamund.

Sri K. P. Sankunni Menon,	F. M., Govt. Botanical Gardens, Ootacamund,	F. M. Central Farm.
„ V. Satagopan,	A. D., Coimbatore,	Secy, Groundnut Market Committee, Cuddalore.
„ P. Narayanan Nair,	F. M. Nanjanad,	A. D., Coimbatore.
„ K. M. Venkatachalam,	A. A. D. Cuddalore,	Market yard Supdt. Groundnut Market Committee, Cuddalore.
„ M. A. Balakrishna Ayyar.	A. D. Vellore,	F. M., A. R. S., Koilpatti.
„ M. Gopala Unnithan.	A. D., Gudiyatam,	A. D., Vellore.
„ Edwin Amirtha Raj,	...	F. M., A. R. S., Nanjanad.
„ A. M. Muthayya Nattar,	A. D., Tirupur,	Market yard Supdt., South Arcot, G. M. C., Cuddalore.
„ P. Janakirama Ayyar,	A. D., Tirukoilur,	Market Yard Supdt. South Arcot, G. M. Committee, Cuddalore.
„ A. Chidambaram Pillai,	A. D. Madura,	Market Yard Supdt., South Arcot, G. M. Committee, Cuddalore.
„ R. Vasudeva Rao Naidu,	A. D., Bhimlipatam,	Secretary, Tobacco Market Committee. Guntur.
„ D. C. Hanumantha Rao,	A. D., Kovvur,	Agricultural Marketing Asstt., Bezwada.
„ A. H. Subramania Sarma,	F. M. Central Farm, Coimbatore.	Agricultural Marketing Asstt., Coimbatore.
„ P. S. Athmarama Ayyar,	A. D., Kumbakonam,	Agricultural Marketing Asstt., Trichinopoly.
„ K. Regunatha Reddy,	A. D., Chandragiri,	Agricultural Marketing Asstt., Madras.
Janab Shaik Hussan Saheb,	A. D., Cuddapah,	A. D., Kamalapuram.

2. Leave.

Name of officers.	Period of leave.
Sri C. Krishnan Nayar, Asst. to Mycologist, Coimbatore.	L. a. p. for 4 months from 12—5—39.
„ M. Somayya, F. M., A. R. S., Nandyal.	L. a. p. for 1 month from 6—5—39.
„ L. Neelakantan, Asst. in Cotton, A. R. S., Nandyal.	Extension of l. a. p. for 22 days from 24—5—39.
„ R. Venkatarama Ayyar, A. A. D., Virdachalam.	L. a. p. for 3 weeks from 8—5—39.
„ S. Veeravarada Raju, A. D., (on leave)	Extension of l. a. p. on m. c. for 2 months from 19—5—39.
„ R. Vasudeva Rao Naidu, A. D., Bhimlipatam.	L. a. p. for 1 month from the date of relief.
„ T. Lakshmipathy Rao, A. D., Kovvur.	L. a. p. on m. c. for 1½ months from 29—4—39.
„ K. Balaji Rao, A. A. D., Siruguppa.	L. a. p. for 3 months from 15—5—39.
„ K. Hanumantha Rao, A. A. D., (on leave)	Extension of l. a. p. for 1 month and 28 days from 29—4—39.

Sri. P. Vishnusomayajulu, Asst. Mycology, Coimbatore.	L. a. p. for 14 days from 25--5—39.
" D. Panakala Rao, A. D., Ramachandrapuram.	L. a. p. for 3 weeks from the date of relief.
" N. C. Tirumalachari, F. M., Cotton Breeding Station, Coimbatore.	Extension of l. a. p. for 1 month from 15—5—39
" C. V, Sankaranarayana Ayyar, Sub-Asst., Paddy Station, Coimbatore.	L. a. p. for 1 month from 11—5—38.
" K. M. Jacob, A. D., Manantody,	L a. p. for 2 months from 10—5—39.
" S. Krishnamurthy, F. M., Central Farm, Coimbatore.	L. a. p. for 1 month from 8—5—39.
" P. S. H. Narayanaswami Naidu, F. M., S. R. S., Gudiyattam,	L. a. p. for 2 months from 24—5—39.
" V. Chidambaram Pillai, F. M., A. R S., Koilpatti,	L. a. p. for 2 months from 8—5—39.
" S. Sundram, Asst. in Cotton Coimbatore.	L. a. p. for 4 months from the date of relief.
" G. K. Chidambaram, Asst. in Chemistry, Coimbatore.	L. a. p. for 1 month from 8—5—39.
" S. V. Doraiswami Iyer, F. M., A. R. S, Guntur.	L. a. p. for 1 month from 4—5—39.
" J. Suryanarayana, A. D. Gurzala,	L. a. p. on m. c. for 1 month from 4—5—39.
" M. Narasimham, A. D., Guntur.	L. a. p. on m. c. for 1 month from 3—5—39.
" D. Hanumantha Rao, A. D., Kothapetta.	L. a. p. on m. c. for 1 month from 24—4--39.
" C. S. Balasubramaniam, Asst. in Entomology, Cuddapah.	Extension of l. a. p. on m. c. for 6 weeks.
" S. Ponnuswami Naidu, A. A D. Ambasamudram.	L. a. p. for 1 month from 21—4—39.
" P. V. Somu Ayyar, A. A. D, (on leave)	Extension of l. a. p. on m. c. for 1 month from 6—5—39.
" S. Mayandi Pillai, Asst. in Cotton, A. R. S., Koilpatti.	Extension of l. a. p. for 4 months on m. c. from 13-4-39.
" S. Bhima Raju, A. A. D., Tadpatri.	Extention of l. a. p. on m. c. for 2½ months from 3-5-39.
" C. A. S. Ramalingam Pillai, A. A. D., Ariyalur.	Extension of l. a. p. on m. c. for 6 weeks from 9-4-39.
" G. J. Balaji, A. A. D., Pattukottai.	Extension of l. a. p. on m. c. for 3 months from 3-4-39.
" M. K. Padmanabhan, Asst. in Paddy, A. R. S., Pattambi,	L. a. p. on m. c. for 3 months from 15-4-39.
" M. Bhavani Shanker Rao, Asst. in Oilseeds, Coimbatore.	L. a. p. for 30 days from 24-4-39.
" C. S. Sankaranarayana Ayyar, A. D., Hosur.	L. a. p. for 19 days from 25-5-39.
" M. C. Menon, A. D., Tirupattur.	L. a. p. for 1 month from 18-5-39.
" T. D. Eswara Ayyar, Asst. F. M., Sim's Park, Coonoor.	L. a. p. for 15 days from 24-5-39.
" M. K. Gopalan, A. D., Proddatur.	L. a. p. for 1 month from 29-5-39.
" B. G. Narayana Menon, Off. F. M., A. R S., Nileshwar.	Extension of l. a. p. for 20 days from 12-5-39.
" V. V. S. Varada Rajan, F. M., A. R. S., Guntur.	L. a. p. for 1 month from 25-3-39.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library During April 1939.

A. Books.

1. *State Interference in South Africa.* Biljon, F. J. Van. (1939). 2. *New Research Data on Fertilizers* Berliner & Staff, J. J. 3. *Vegetables of New York: The Cucurbits.* Tapley, W. & etc. (1937). 4. *Index Kewensis Plantarum Phanerogamarum Supplementum IX (1931 -1935).* Hill, A. W.

B. Annual Proceedings and Reports.

1, 2, 3 & 4. Proceedings of the 25th Indian Science Congress, Part I—Official, 1938, II—Presidential Addresses, 1938, III—Abstracts, 1939 and IV--Late Abstracts, Discussions, 1939. 5. Mauritius Annual Report of the Department of Agriculture for 1937. 6. Mauritius Annual Report on the Co-operative Credit Societies for 1938. 7. New Brunswick Annual Report of the Department of Agriculture for 1938. 8 & 9. Proceedings of the National Institute of Science of India, Vol. 4, No. 3 and Vol. 4, No. 4. 10. Tafo, the Cocoa Research Station first Annual report for 1937-38. 11. Nagpur Northern Circle Report on Demonstration work for 1938. 12. Nagpur Western Circle Report on Demonstration work for 1938. 13 & 14. Ames, Iowa, report on Agricultural Research Station for 1937, Part I and II. 15. Michigan State College Agricultural Experiment Station report for two years ending June 30, 1938. 16. Annual Report of the Director of the Agricultural Experiment Station, Madison, Wisconsin, Part I, 1938. 17. British Guiana Divisional Report of the Department of Agriculture for the year 1937. 18. Proceedings of the First Meeting of the Wheat Committee held at Simla on 10th and 11th July 1936. 19. Annual Statement of the Sea Borne Trade of British India with the British Empire and Foreign Countries for the year ending 31st March, 1938 Vol. 1.

C. Special Reports and Publications.

20 & 21 Report on the Cost of Production of Crops in the Principal Sugarcane and Cotton tracts in India. Vol. I—The Punjab, 1938 and Vol. II—Bombay, 1938. 22. Report of the Committee of the Indian Sugar Mill for the year 1937-38. 23. Season and Crop report of the Bombay Province for 1937-38. 24. Health Bulletin No. 1—Hookworm infection in India, with notes on Symptoms, treatment and prophylaxiz by Maplestone, P. A., 1939. 25. Bibliography of Soil Erosion Part 1—Indian Section by Gorrie R M., 1939. *I. C A. R. Mis. Bull. No. 28.* 26. Tecklai Experimental Station Annual Report for 1936: Chemical Branch, 1939. 27. Tecklai Experimental Station Annual Report for 1936: Agricultural Branch, 1939. 28. Tecklai Experimental Station Annual Report for 1936: Mycological, Botanical and Bacteriological Branches, 1939. 29. Tecklai Experimental Station Annual Report for 1936: Proceeding of the 1st Annual Conference, 1939. 30. Tecklai Experimental Station Annual Report for 1936: Proceeding of the 2nd Annual Conference, 1938.

D. New Periodicals.

Agricultural Life.

UNIVERSITY OF MADRAS

B. Sc. Ag. Degree Examination —1939.

LIST OF SUCCESSFUL CANDIDATES

First Examination. Atchuta Rama Raju; Bhaskara Reddy, N.; Chinnappa Reddy, D.; Daniel Sundararaj, D.; Hanumantha Rao, B.; Jagannathan, N.; Meenakshisundaram, M. N.; Muhamed Ibrahim, P. A.; Narappa Reddy, D.; Narasimham, B.; Narasimhamurthy, D.; Narayana Kamath, H.; Narayana Nambiar, M.; Paramananda Panda; Rajagopalan, V. R.; Ramalingam, G.; Ramalingam, M.; Ramarao, G.; Ramana Rao, D. V.; Ramanamurthy, P. V.; Ramasubramaniam, S. N.; Santanaraman, T.; Sanyasi Rao, U ; Satyanarayana Murthy, K.; Seshavathram, B ; Shaukat Ali. K. A.; Sheenappa. K.; Somanna K. M.; Srinivasulu, N.; Srinivasan, S T.; Srinivasan, S. V.; Sambamurty, K.; Tiruvengalachari, T. K.; Vasudeva Rao, B.; Venkataramanamurthy, C.; Venkateswara Rao, P.; Venkateswara Rao, T.; Kavulutlayya, M. C.; Radhakrishna Rao, D.; Srinivasan, N, V.; Thygaram, U. V.

Second Examination. Azariah, M. D.; Bhaskaram, K.; Bhaskara Rao, M. V.; Cunha, E. V. J.; Fazlullah Khan, K ; George Harris Maduram.; Jagannatha Rao, E.; Kailasa Rao, T.; Kesava Reddy, A. G.; Mohan Punja, M.; Muhammed Sulaiman, S. M.; Murti Raju, K.; Muthuperumal, V.; Muthuswami, T. D.; Narayana Rao. K.; Narayana Reddy, B.; Padmanabha Raju, B.; Peeraraju, A.; Raghavulu, G. V.; Rajasehekara Shetty, K.; Ramanathan, R.; Ramaswami, K. S.; Ramaiah, M.; Sambandam, R.; Śivasubramaniam, T.; Srinivasan, K.; Sumitra Rao, U.; Venkataratnam, L.; Veeraraghavan. R.; Aiyappa, K. M.; Chellappa, G. V.; Dinker Rao,; Karuppiah.; Kulandaiswami, M. S.; Muhammad Baig ; Viswanathan, T. K.

Final Examination. Dinker Rao.; Karuppiah, K.; Viswanathan, T. K.; Alagiriswami, R. V., Balakrishna, N.; Gnanadurai Pandla Raj.; Jayaraman, V.; Jogi, S. K.; Kunhirama Menon, K., Mahabala Shetty, K.; Mahalingam, K S.; Muhammad Khasim Adeni.; Muhammad Zainulabdeen.; Nagaraja Rao, M. R.; Narasimhamurthy, H.; Narayana Rao, D.; Rajaraman, M. G.; Rama Aiyangar T. M.; Ranga Rao, P. V.; Sankaram, A.; Sankaran, K. S.; Satya Narayana Reddi, N.; Seshachalapati, Rao, A.; Seetharaman, P. N.; Srinivasan, V.; Subramanian. R.; Syed Ibrahim.; Venkatasubrahmanian, V.; Viswanathan, R.; Shaik Abdul Hafiz.; Joseph Doss, S. V.; Kothandaraman, E. S.; Lakshmana Babu. P.; Marthappa Kini, T.; Mohammad Fasiuddin.; Ramanna, V.; Seshadri, C. K.; Krishnaswami Naidu, D.; Mohan Rao, B. K.; Mukundan, M.; Ramalingam, V.

The following candidates have references in the subjects noted :—

Second Examination. Animal Hygiene-Krishnamurthy, C. S.; Padmanabha Rao, K.; Sreshta Noel.; Engineering-Vengala Rao, K. C.; Venkateswara Chayanulu, U.; Gopalakrishna Gokhale, V.

Final Examination. Chemistry-Muhammad Baig. Agricultural Economics and Farm Management-Ananthararaman, R.; Francis Samuel.; Selvarajan A.; Srinivasan, P. S.

The Madras Agricultural Journal.

(ORGAN OF THE M A. S. UNION)

Vol. XXVII.] JUNE 1939 [No. 6.

EDITORIAL

Eat more fruit. Fruits have now come to be recognised by the physicians and dieticians as an essential part of healthful diet all the world over. They are said to contain base-forming elements in abundance to correct the harm caused by the acid-forming foods that form the more common diet of an average Indian. Generally he is not known to take to a liberal use of fruits excepting on festive occasions. He still labours under a mistake that the fruits are costly luxuries intended only for the well-to-do classes. Part of his apathy is due perhaps to his general poverty and a part to the lack of knowledge to appreciate the value of fruits. He does not know yet that fruits have in them wonderful health-giving substances in abundance and they must be taken as an article of food in liberal quantities to keep him fit and free from ills.

Dearth of fruits should not be a factor to keep off people from developing the fruit eating habit. Fortunately for us we live in the Tropics which grow a wide variety of fruits in plenty. Though apples, plums and peaches require higher elevations, the bulk of fruits like the mangoes, plantains, oranges, guavas, papaya, sapota, bher, tomatoes, grapes etc., can be raised with ease in the plains and there will be no necessity to import them from elsewhere. The railways now afford speedy transport for transhipment of the produce from the production centres to the regular markets. Provision of cold storage facilities will come into existence as a matter of course when a demand for fruit is created among the people by persistent propaganda. With the Prohibition Act now in force in three districts and the possibility of its extension over the whole province, there will be more fluid money in the hands of the poorer classes who will be ready to spend it on fruits if they are induced to do so. Here, then, is an opportunity for the prospective fruit grower to increase the fruit production and make it available to the poor man at reasonable rates and capture a potential market. By so doing he will not only be benefiting himself but rendering a national service by raising the general level of health of the people. The fruit eating habit is bound to make them sturdy and hardy citizens in the long run.

The Government are keenly alive to this aspect of the problem and have opened a Fruit Research Station at Kodur, Cuddapah district, whose

function it will be to supply seedlings and grafts from pedigree stock to the fruit growers and help them with up-to-date technique in the art of fruit culture. There is a prospect of a few more stations being opened with a view to encouraging the fruit industry.

To stimulate the fruit—eating habit and fruit production we are endeavouring to publish a series of articles on fruits the first of which appears in the current issue under the title, "A note on the cultivation of bananas in the Madras Presidency".

Market Gardening. Though the cry of "back to the villages" is now more vehemently uttered and heard, the tendency still seems to be for the populace to move out into the urban centres, where industries like the textiles are becoming established. With the growth of such industries, concentration of population is bound to result round about them. Since this population has to depend upon the crop growers for its daily requirements of vegetables, fruits and flowers, a market is assured to any one who ventures to take to their production in the neighbourhood. Tomatoes, brinjals, chillies, jasmines, roses and chrysanthemums are a few among the produce that would find a ready sale. For cultivators situated far away, the bus and lorry furnish the quickest means of transport to market the products. It is well known that jasmines of Dharapuram are rushed to Coimbatore by bus and made available to the customers in time with all its freshness. There is little doubt that market gardening in the vicinity of our Indian homes has a good future before it and only a steady effort is needed to utilize the demand to one's own advantage.

A Note on the Cultivation of Bananas in the Madras Presidency.

By K. CHERIAN JACOB, L. Ag., F. L. S.
Agricultural Research Institute, Coimbatore.

Introduction. The term banana includes all varieties of plantains, fruit or vegetable. Banana is an important commercial crop in South India. It yields very good profits especially when grown in the vicinity of cities, towns and places of pilgrimage. Though the banana is known to cultivators for very many years yet a large number of them do not know the proper method of its cultivation. During the recent banana survey in this Presidency many cultivators evinced keen interest in knowing the proper method of its cultivation. This short note is therefore intended to give in broad outlines some information on the method of banana cultivation. At the end of the paper some of the more common banana varieties are mentioned with short notes on each.

Soil and elevation. Banana can be successfully grown from sea-level to 5,500 feet in elevation in any kind of soil, black, red, clayey or sandy, provided there is enough water for irrigation and good drainage. Though banana needs a good deal of water it cannot stand water stagnation.

Preparatory cultivation. The land after the harvest of the previous crop should be ploughed well at least four times. After the second ploughing farmyard manure at 20—30 cartloads per acre should be applied and then the other two ploughings given. The interval between ploughings should be at least a week.

Season of planting. There is no particular season for planting banana suckers except that they should not be planted during the very cold months (15th November to 15th February) when the growth of plants in general is not vigorous.

Planting. Pits measuring $1\frac{1}{2}'$ cube should be dug in lines 7′ apart and in rows 8′ apart and exposed to weathering for a fortnight. Immediately before planting suckers, the pits should be filled to three-fourths with a mixture of half a Madras measure of wood ashes and surface earth, care being taken that the subsoil removed from the pits is not used in preparing the mixture.

Rhizomes for planting. Well developed sword-leaved suckers or young broad leaved ones should be removed without damaging the rhizomes four or five days previous to planting. All the roots of the suckers should be trimmed, damaged portions of the rhizomes, if any, cleanly sliced off and the suckers heaped in a shady place. On the day of planting, these suckers should be distributed one to each pit. Before planting, the top portion (pseudo-stem) of the sucker above the rhizome should be cut off obliquely to a height of one foot from the rhizome. The sucker is then planted upright in the centre of the pit in such a manner that the rhizome

portion is completely buried in the soil. The pit is then filled up with earth leaving about 6 to 9 inches of the sucker (pseudo-stem) exposed. The soil all round the suckers should be well pressed in order to give them firm stand in the pit.

A soaking irrigation should be given on the same day of planting or the next day. Subsequent irrigations are to be given once a week in loamy soils, once in three days in sandy loams and every other day in sandy soils. During monsoons, however, such frequent irrigations will not be necessary.

After Cultivation. The first *mamooti* hoeing should be given a month after planting and the subsequent hoeings as and when weeds appear. On an average 6 hoeings are to be given in the course of a year. The weeds especially the *korai* (*Cyperus rotundus* L.) should be removed with the rhizomes (nuts). Ploughing the area after the suckers have been planted is not advisable even though this practice is in vogue in some parts of the Presidency.

In heavy soils where there is water stagnation, trenches one foot deep and one foot broad should be dug between every two rows during the monsoonic months and the stagnant water drained off. With every *mamooti* hoeing these trenches should be cleaned and gradually deepened in order to facilitate easy drainage.

In soils which are well drained trenching is not necessary. In such soils the land should be formed into beds, each bed enclosing about 4 to 6 plants in order to economise irrigation and conserve rain water.

Manures and Manuring. Bulky organic manures such as well rotten farmyard manure, powdered *poonacs* of all sorts, tannery refuse, green leaf, etc., are generally applied. A dressing of Ammonium sulphate is found beneficial in certain localities. Wood ashes will increase the keeping quality of bananas.

When the young plants have put forth 6 to 7 leaves, soil all round the plants to a radius of 18" and up to the level of the roots is removed. Well rotten farmyard manure or in its absence powdered poonacs or tannery refuse is spread evenly all round the plants at rates 2 baskets, 1½ lbs., 2 lbs., respectively per plant and covered with earth. A soaking irrigation should be given immediately after manuring.

A second dose of manure should be given when the plants are about to flower. By this time the suckers would have put forth 7 to 8 leaves. Both the main plant and the sucker should be manured. Manuring in subsequent generations should be similarly done both for the main plant and the sucker at the time when the main plant is about to flower and the sucker has put forth about 7 to 8 leaves.

De-suckering. Young suckers will begin to sprout from the sixth month onwards. The first and the second suckers should be removed as they appear *with a portion of the rhizome* by a specially made crowbar without causing injury to the mother plant. The third sucker is allowed to come up for the succeeding generation. All suckers that come up subsequently

should be removed like the first and second, the object being that only one sucker is allowed to come up for the succeeding generation. When the main plant is harvested the sucker that was allowed to grow by its side becomes the main plant in the next generation. In this manner in the course of three years four bunches can be harvested from each stool. The crop in the fourth year can be left for the purpose of leaves and this time three to four healthy suckers can be allowed to come up in each stool. To meet any leaf requirements from the first year crop, one or two rows of plants all along the margins of the plantation may be set apart for this purpose and 3 to 4 healthy suckers allowed to develop in each stool.

Propping. If there be strong winds when the "trees" are in bunches or when the bunches are heavy, it is advisable to support individual plants with bamboo or *Agathi* (*Sesbania grandiflora* Pers.) props. Double or single props with a fork at one end may be used. In the varieties Bontha, Rasthali and Vamanakeli, propping is not necessary since the first two have very deep and strong root systems and the other is dwarfish.

General. The cone-like inflorescence (heart) should be removed after all the pistillate (female) flowers have developed into fruits. *Agathi* plants may be planted on the outskirts of banana areas as wind-break especially on the windward side. These plants, however, should be pruned periodically. These provide protection for banana plants, fodder for the cattle and food for the owner.

Common commercial varieties of bananas and their availability.

Poovan. (*Musa paradisiaca* Linn., var. *Poovan*)

Local names—Mysore, Bengala, Paleyangodan, Karpura Chakkarakeli, Vasana Chettu, Ginni, Adukku Namarai, etc.

One of the most popular banana varieties. It is a good fruit and can also be used as a vegetable. Suckers are available from Rajahmundry, Samalkota, Erode, Coimbatore, Trichinopoly, Tellicherry, etc. It thrives well in all soils and localities. The fruits are in great demand throughout the Presidency.

Rasthali. (*Musa paradisiaca* Linn., var. *Rasthali*)

Local name—Poo Bare, Rasa Bale, Anai Poovan, Poovan, Ari Poovan, Nattu Poovan, Desi, Mokiri, Amritapani, etc.

One of the best varieties of bananas exclusively used as fruit. The fruits have a good flavour and taste and there is a good demand for them throughout the Presidency. Suckers are available from Khandavalli (Tanuku, West Godavari District), Erode, Trichinopoly, Tellicherry, etc. It can be successfully grown in all soils and places.

Vamanakeli. (*Musa paradisiaca* Linn., var. *Cavendishii*)

Local names—Pacha Vazhai, Kabul Bale, Guja Bale, Kuzhi Nendran, Kooli Vazhai, Kooni Vazhai, Nila Vazhai, Kandy Vazhai, Mauritius, etc.

A good variety of banana exclusively used as fruit. The fruits have a fine flavour and taste and are in great demand in the Madras City. It can be grown in all soils and localities. It needs heavy manuring. It is a dwarf variety. The colour of the ripe fruit is greenish. Suckers can be had from Samalkota, Erode, Trichinopoly, Sadras near Madras, Trichur, etc.

Chakkarakeli. (*Musa paradisiaca* Linn., var. *Chakkarakeli*)

Local names—Thella Chakkarakeli, Then Kadali, Shahaja, Chakkara Kadali, Godaveri Chakkarakeli, Rajah Vazhai, etc.

The best of all the banana varieties exclusively used as fruit. It can be said of this variety as the King of the Bananas. The fruits have an excellent flavour and taste. The ripe fruits literally melt in the mouth. There is a great demand for the fruits at Rajahmundry, Samalkota, Madras City, etc. It can be grown in all soils and localities. Suckers can be obtained from Rajahmundry, Samalkota, Trichur, etc.

Virupakshi. (*Musa paradisiaca* Linn., var. *Vannan*, ecological type *Virupakshi*)

Local names—Virupakshi, Vella Vazhai, Mala Vazhai, etc.

It is a hill variety and thrives in mountainous tracts at altitudes between 3,500 to 5,000. It is an excellent fruit with fine flavour and taste. The fruits are not juicy and have a good keeping quality. There is a good demand for the fruit in all the southern districts. When grown in the plains, however, the variety deteriorates and the fruits lose their fine flavour and taste. Suckers can be had from Pannakkadu near Kodaikanal Road Railway Station.

Sirumalai. (*Musa paradisiaca* Linn., var. *Vannan*, ecological type *Sirumalai*)

Local names—Uduran Vazhai, Sirumalai, Mala Vazhai, etc.

This is also a hill variety of banana but thrives at less altitudes than Virupakshi. It is largely grown in the Sirumalai Hills of Madura District at altitudes between 2,000 to 2,500 feet Hence its name Sirumalai. The fruits have a fine flavour and taste and are slightly juicy. Like the Virupakshi they also have a good keeping quality. There is a good demand for fruits in all the southern districts and Madras City. When grown in the plains the fruits slightly lose their flavour and taste. Suckers can be obtained from Sirumalai near Dindigul.

Ney Mannan. (*Musa paradisiaca* Linn., var. *Ney Mannan*).

Local names—Vayakkattu Kai, Nattu Vazhai, Thiyyan Mannan, Kallu Vannan, Ney Vannan, Mala Mundi, etc.

This is a variety which is chiefly used as vegetable, but sometimes also used as fruit. As a vegetable there is a good demand for the unripe fruits in Madura, Ramnad and Tinnevelly Districts. The ripe fruits have very little flavour and taste. Suckers can be obtained from Dindigul, Tinnevelly, Madura, etc.

Nendran. (*Musa paradisiaca* Linn., var. *Nendran*)

Local names—Nendra Bale, Thiruvonan, Etthakka, Chengazhikodan, etc.

The most popular variety of bananas in the West Coast. There are two other sub-varieties in this, viz., Attu Nendran and Myndoli. The fruits as used both as vegetable and as ripe fruits. The ripe fruits being tough need steaming before use. The fruits have a very good keeping quality. Many preparations are made of both unripe and ripe fruits. The cultivation of this variety is at present chiefly confined to the West Coast. This variety, however, can be grown in other places as well. Suckers can be obtained from Calicut, Tellicherry, Trichur, etc.

Nalla Bontha. (*Musa paradisiaca* Linn., var. *Nalla Bontha*)

Local names - Pacha Bontha, Bonthan, Nattu Ka, Katta Bontha, etc.

This is a variety the fruits of which are mainly used as vegetable. There is a great demand for this in the Madras City and northern districts. It thrives in all soils and localities. Suckers can be obtained from Rajahmundry, Samalkota, Ponneri, Trivellore, etc.

Monthan. (*Musa paradisiaca* Linn., var. *Monthan*)

Local names—Silanti, Manga Bale, Ounda Bale, Manga Kai, Sodari, Thezhuthani, Thenali, Ponthan, Chetti Kaya, Nathaangi Monthan, Yenthala Monthan etc.

The fruits of this variety are chiefly used as vegetable, but sometimes also as ripe fruits. As a vegetable it is in great demand throughout the Presidency. The ripe fruits have very little flavour and taste. It thrives well in all soils and localities. Suckers can be obtained from Erode, Trichinopoly, Coimbatore, etc.

Notes on Perina Nuda Fabr., [Lymnt. Lepid.), and Its Natural Enemies.

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Introduction. Fig trees are commonly regarded as being free from serious pests. They are, however, occasionally attacked by different species of caterpillars which assume some importance when found in large numbers. One such pest is *Perina nuda Fabr*. During the periods of abundance appreciable damage is done by the larvae of this pest which defoliate the trees, leaving only the midribs and larger veins of the leaves with ragged shreds of leaf tissue.

Perina nuda is reported by Hampson (1892) to occur throughout India, Ceylon and China and observed to feed on leaves of Mangifera indica (Barlow 1900) *Ficus indica* (Fletcher 1919), F. religiosa (Forsayeth 1884) and *Artocarpus integrifolia* (Lefroy 1909 and Swinhoe 1885). From Coimbatore it was first reported on figs in 1917 by Ramachandra Rao (1917).

Life History of the Pest. *Egg.* The eggs are generally laid in clusters on the under surface of the leaves. These are found in rows, each egg opposite the space between two eggs in the adjacent row and are placed close together.

The egg is almost cylindrical, rounded, tapering towards the end which is attached to the leaf. The micropyle surface is flat with a small depression at the centre. In general colour the egg when freshly laid is light pink. The micropyle surface is deep pink enclosed in a white circle which again is enclosed in a light pink circle. Measurements of a number of eggs averaged as follows: Length 0·7 mm. Width at the micropyle end 0·5 mm: Width at the attachment to the leaf 0·4 mm.

The egg period varies from 4—6 days. Table I gives the egg laying records of 12 females. The maximum number of eggs laid by a female was 409 and the minimum 57 the average being 203.

Larva. *(First instar.)* The larva gnaws a hole in the micropyle end of the egg and wriggles out of the shell. The general colour of a newly hatched larva which measures 1·8 × ·5 mm. is orange yellow to sulphur yellow. Head is of the same colour and wider than the rest of the body. The posterior portion of the latter is narrower than the anterior and light orange yellow in colour. Thoracic segments are sulphur yellow in colour with white hairs on them. The first two abdominal segments bear a median longitudinal dark stripe with two dark tuft-like growths on the lateral side of each segment. The third segment is sulphur yellow. The 4th, 5th and 6th segments bear a median longitudinal sulphur yellow stripe with a dark stripe on either

TABLE I. Oviposition record of twelve moths of Perina nuda Fabr.

Moth No.	Pair Emerged on	First batch		Second batch		Third batch		Fourth batch		Fifth batch		Sixth batch		Total No. of Eggs.
		Eggs laid on	No. of Eggs	Eggs laid on	No. of Eggs	Eggs laid on	No. of Eggs	Eggs laid on	No. of Eggs	Eggs laid on	No. of Eggs	Eggs laid on	No. of Eggs	
1	8 10 35	9 10 35	232											232
2	9 11 35	11 11 35	8	12 11 35	5	13 11 35	12	14 11 35	72	15 11 35	56			153
3	9 11 35	12 11 35	5	13 11 35	43	14 11 35	115	16 11 35	16					179
4	9 11 35	11 11 35	15	12 11 35	43	13 11 35	11	14 11 35	44	16 11 35	10			153
5	9 12 35	12 11 35	86	13 11 35	10	14 11 35	19	15 11 35	24	16 11 35	60			199
6	10 12.35	12 12 35	8	13 12 35	9	14 12 35	25	15 12 35	198	16 12 35	33			273
7	17 1 36	19 1 36	273	20 1 36	52	21 1 36	40	22 1 36	8	23 1 36	15	24 1 36	21	409
8	25 1 36	29 1 36	26	30 1 36	40	31 1 36	250							316
9	F. 11 2 36 M. 15 2 36	17 2 36	4	18 2 36	10	19 2 36	12	20 2 36	21					57
10	18 2 36	20 2 36	2	21 2 36	35	25 2 36	35							72
11	19 2 36	21 2 36	155	23 2 36	85									240
12	19 2 36	21 2 35	23	23 2 36	40	25 2 36	74							158

side. The 7th segment is dark. The 8th is light orange yellow. The 9th and 10th bear long hairs. The first instar lasts 3—4 days.

(Second instar.) The larva immediately after the first moult measures 6 × 1·5 mm. Head is black: thorax is light greenish yellow. The 7th abdominal segment bears a glandular protuberance of pink colour. The second instar lasts 2—3 days.

(Third instar.) The larva immediately after the moult measures 6 × 2 mm. The general appearance of the larva is now distinctly black with a white median longitudinal band and with long white lateral hairs. Head is distinctly black. The 6th abdominal segment develops a globular and glandular protuberance of white colour. The 7th segment bears a similar protuberance of yellow colour. The third instar lasts 3—4 days.

(Fourth instar.) The larva immediately after the moult measures 8 × 3 mm. In general appearance the larva at this stage does not differ from the larva of the previous instar. The fourth instar lasts 2—4 days.

(Fifth instar.) The larva immediately after the moult measures 15 × 5 mm. In general appearance the caterpillar shows no distinct difference from the previous stage. Head is olive brown in colour. On the first thoracic segment two dullred coloured tufts of hairs are seen on the lateral sides. The fifth instar lasts 2—4 days.

(Sixth instar.) The larva after the moult measures 23 × 5 mm. There is a distinct change in the colour of the caterpillar. Head is of drab colour. Body segments bear a dorsal series of short tufts of blackish hairs with particularly long tufts projecting over the head and anal segments, and lateral tufts of longish grey and black hairs. The larva bears a dark sap green band broken by a whitish band on second, third and fourth segments, two red spots on the green band on the side of the second, third and fourth segments, and a sub-dorsal row of dark blue tubercular spots from the 5th segment. The sixth instar lasts 3—4 days. The total active larval life varies from 16—20 days. In the case of three females seven moults were however, noticed.

Pupa. The larva when full fed pupates in the leaf fold formed by the fibres of silken threads produced by the larva. The pupa is hairy and brightly coloured on the dorsal side and pale yellowish white on the ventral. The male and female pupae measure 16 × 5·5 mm. and 18 × 6 mm. respectively. The pupal period varies from 5—9 days.

Moth. The following description has been adopted from "The Lepidoptera of Ceylon" Vol. II by F. Moore (1883).

"*Male:* Forewing transparent, except at the base, which is obliquely covered with pale ochreous-brown scales; hindwing pale ochreous-brown, darkest towards anal angle; a transparent spot at the apex; thorax pale ochreous-brown, abdomen blackish, with narrow whitish segmental bands, anal tuft reddish-ochreous; head, palpi, and legs above pale reddish-ochreous; antennae brown.

Female; dull ochreous-white, the base of posterior border sparsely irrorated with minute black scales. Body dull ochreous-white; head, palpi, legs, and anal tuft pale ochreous. Expanse, ♂ $1\frac{3}{8}$, ♀ $1\frac{5}{8}$ inch."

Generally the moths begin to emerge in October. The females are much larger and have cream-white wings and body. On emergence the females are sluggish and dull in disposition and inactive at all times as compared with the males. During the day the moths are for the most part quiescent and become active just at dusk. The male lives from 3–10 days and the female from 5—11 days. The total life cycle varies from 27—39 days. Table II gives the life history records of 15 moths kept under observation.

TABLE II. Life History Records of Perina nuda, Fabr.

Ser. No.	Eggs laid on.	Eggs hatched on.	Egg period in days.	Pupated on.	Larval period in days.	Adult emerged on.	Pupal period in days.	Total life cycle.	Sex of the adult.
1	9 10 35	14 10 35	5	29 10 35	15	7 11 35	9	29	M.
2	9 10 35	14 10 35	5	29 10 35	15	7 11 35	9	29	F.
3	12 12 35	17 12 35	5	8 1 36	22	17 1 36	9	37	M.
4	12 12 35	17 12 35	5	11 1 36	25	17 1 36	6	37	M.
5	12 12 35	17 12 35	5	11 1 36	25	17 1 36	6	37	M.
6	12 12 35	17 12 35	5	14 1 36	28	19 1 36	5	39	F.
7	19 1 36	25 1 36	6	16 2 36	22	21 2 36	6	33	F.
8	19 1 36	25 1 36	6	13 2 36	19	18 2 36	5	30	M.
9	19 1 36	25 1 36	6	13 2 36	19	18 2 36	5	30	F.
10	19 1 36	25 1 36	6	16 2 36	22	21 2 36	6	33	F.
11	19 1 36	25 1 36	6	10 2 36	16	15 2 36	6	27	M.
12	19 1 36	25 1 35	6	14 2 36	20	19 2 36	5	31	F.
13	19 1 36	25 1 36	6	13 2 36	19	18 2 36	5	30	M.
14	19 1 36	25 1 36	6	14 2 36	20	19 2 36	5	31	M.
15	19 1 36	25 1 36	6	13 2 36	19	18 2 36	5	30	F.

The temperature and humidity at which the pest was studied are given below:—

TABLE III. Temperature and humidity at which the pest was studied.

Particulars.	October 1935	November 1935	December 1935	January 1936	February 1936
Mean Minimum temperature in shade	70·9°F	68 1°F	65·8°F	64·4°F	67 9°F
Mean Maximum temperature in shade	87·8°F	86·1°F	84 9°F	84·8°F	91·0°F
Mean humidity at 8 hours	78·9%	74·2%	75·1%	73·8%	75·4%

Natural Enemies. 1. An un-identified tiny Chalcid has been noted on the eggs of this pest.

2. *Megarhogas n. sp.* Mr. Muesebeck of the Bureau of Entomology, Washington to whom this Ichneumonid was sent for identification has

declared it to be a new species. The parasite attacks fairly grown up caterpillars. The egg is laid inside the body of the host and the grub feeds internally. A parasitised larva is dull and on the 5th day after it is parasitised it presents a bloated appearance. After another 5 days the parasite emerges by cutting a hole through the dried skin of the larva.

3. *Tricholyga sorbillans Wied.* This Tachinid parasite lays its eggs on the body of the larva. Each female generally lays 40—85 eggs distributed on several caterpillars. The eggs laid on a single caterpillar vary from 1—55. But when a parasite is supplied with a large number of caterpillars, it distributes its eggs on them. It generally attacks caterpillars which are about to pupate but even young caterpillars are also attacked and oviposited. The eggs hatch out in a day and generally the parasitised host presents a dull appearance and does not moult. The grubs after hatching enter the body of the larva and feed inside for 4 days after which they come out and pupate. Only 1—3 grubs come out from each host. The pupal period ranges from 12—14 days after which the adults emerge. The total life cycle of the parasite varies from 17—21 days. In some cases the parasite lays its eggs on a larva which pupates on the next day. In such cases the eggs hatch out and when the host pupates they live inside the body of the pupa from which the parasitic grubs come out later. The longevity of the females is 20—25 days and that of the males 10—15 days.

4. *Brachymeria euploeae Westw.* Like the Tachinid parasite, this Chalcid is also a larval parasite. The total life cycle is 12—14 days and only one parasite emerges from each host. This has also been collected on Plusia sp.

5. *Goryphus nursei Cam.* From the field collections of Perina nuda larvae, this Ichneumonid parasite has emerged. The same species has been observed at Coimbatore as a parasite of *Ocinara varians*, another pest of figs.

Remedial Measures. Lead arsenate or calcium arsenate when sprayed at a strength of ½ oz. in one gallon of water is found effective against the caterpillars. Dusting with flowers of sulphur as a repellent has also given satisfactory results.

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Large scale trials on the filtration of cane juice with the syphon filter.

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In a previous article by the author in the March issue of the Madras Agricultural Journal 1938, a simple design of filter for the filtration of cane juices has been described and the saving in time effected by its use in comparison with the ordinary filter has been recorded. The above trials were, however, carried out with a small-sized filter under laboratory conditions, using only comparatively small quantities of juice (about 50—70 lbs.).

To see if the new type of filter will work equally satisfactorily under large scale conditions, a bigger filter of the same pattern of the following dimensions was made of copper:—

Top diameter	**1 foot 6 inches.**
Bottom diameter	**1 foot.**
Vertical height	**2 feet 6 inches.**
Length of the syphon tube below the bottom of the filter	**2 feet 6 inches.**
Height of the syphon bend from the bottom of the filter	**1 foot 3 inches.**
Bore of the syphon	**0·5 inch.**

During this crushing season, a number of trials were carried out with this filter. It was found that the arrangement of the different filtering media within the filter viz., gravel, unactivated carbon and activated carbon with wire-gauze partitions between, as described in my previous article was a little cumbersome in large scale working and there was further the likelihood of the unactivated and activated carbons getting mixed up during final cleaning of the filter and interfering with their subsequent reactivation. It would of course, be more convenient if the desired rate of filtration could be obtained by using only one of the two carbons (either the activated or the unactivated) over the gravel layer.

Using unactivated carbon only in the filter, it was found that the rate of filtration was rapid ; but the clarification of juice was not quite satisfactory. A fair amount of carbon dust and other impurities passed through, thereby entailing additional labour and trouble for subsequent removal of these from the boiling, clarified juice. Use of activated carbon only both in the pan and in the filter produced no doubt a high degree of clarification ; but the rate of filtration was comparatively slower, though markedly greater than that with the ordinary filter.

It was further found that the filtration rate could be considerably improved by using in the filter an activated carbon recently heated and cooled and by allowing the carbon-treated and boiled juice to settle for 10 minutes and syphoning off the supernatant liquid into the filter. Below are recorded the results of some typical trials.

Particulars of treatment of juice and of filtering arrangement.		Amount of juice filtered.	Time taken for filtration.	Remarks.
1. 3 lbs. of activated carbon in the pan-gravel up to 1 foot height from the bottom in the filter—above that 10 lbs. of unactivated carbon.	(a)	263 lbs.	20 minutes.	Fine carbon particles passed through
	(b)	267 lbs.	20 minutes.	
2. 3 lbs. of activated carbon in the pan-gravel up to 1 foot from the bottom and 7 lbs. of activated carbon above.	(a)	268 lbs.	25 minutes.	Filtrate clear.
	(b)	232 lbs.	20 „	
	(c)	308 lbs	25 „	
3. 10 lbs. of activated carbon in the pan-gravel as above in the filter—10 lbs. of active carbon above the gravel layer.	(a)	982 lbs.	75 minutes.	Clear filtrate.
	(b)	1002 lbs.	60 „	„
4. Juice boiled with 3 lbs. of activated carbon—allowed to settle for 10 minutes and the supernatant liquid syphoned off into the filter—the filter contained gravel up to 1 ft. height from the bottom and above this a layer of 7 lbs of reactivated carbon freshly heated.	(a)	275 lbs.	12 minutes.	„
	(b)	280 lbs.	12 „	„
	(c)	276 lbs.	15 „	„
	(d)	303 lbs.	15 „	„
5. 7 lbs. of active carbon in the pan. After boiling, allowed to settle for 10 minutes and the supernatant liquid syphoned into the filter which contained a gravel layer 1 foot thick and a 6 inch layer of reactivated carbon above.		700 lbs.	37 minutes.	Filtrate clear.

It will be seen from above that a rapid filtration is obtained by allowing the carbon-treated and boiled juice to settle down for 10 minutes and by employing in the filter activated carbon that has been recently heated and cooled.

As a result of the above trials, the following method may be recommended for securing rapid filtration of cane juices through activated carbon.

The strained raw juice is raised to the boil, the scums removed thoroughly and about 1% of activated carbon on the weight of juice added to the boiling juice in the pan. The boiling and skimming are continued for 10 minutes and the hot juice is transferred to a conical settling tank provided with a tap 3 to 4 inches above the bottom and is allowed to settle down for 10 minutes. The supernatant juice is then allowed to flow into the top of the filter through the tap or in the absence of a tap, the supernatant liquid may be syphoned off into the filter.

For receiving the juice, the filter must be got ready as follows. Coarse gravel (well cleaned) is placed up to a height of 1 foot from the bottom; a wire gauze is placed above the gravel and a layer of activated carbon (preferably recently heated and cooled) about 6" thick over the wire gauze. Water is allowed to flow through the filter through the syphon till all the air is completely driven away from the apparatus. With this arrangement, it has been found possible to filter 1000 lbs. of juice within less than one hour.

By employing two or three filters of this type and a settling tank, large quantities of juice may be filtered with sufficient rapidity.

My thanks are due to the Government Agricultural Chemist and the Superintendent, Central Farm for affording me facilities for carrying out the above tests and to the farm staff for their kind co-operation and willing help.

The Occurrence and Inheritance of Hairiness of Leaf Tip in Sorghum.

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In sorghum the following parts are generally hairy:— (1) the outer side of the triangular auricular junction between the leaf blade and the leaf sheath, (2) the place of insertion, of primary branches on the main axis of the panicle, of secondary branches on the primary branches, and of spikelet branches on the secondary branches, (3) the base of the spikelets (callus hairs), and (4) the pedicels of the pedicelled spikelets. In addition to these, the following parts may or may not be hairy:— (1) the nodal band (the extreme base of the leaf sheath), (2) the inner side of the auricular junction and (3) the glumes. In rare cases the edges of the midrib can also be hairy[1]. In this paper the occurrence and inheritance of hairiness on the tips of leaf blades in sorghum and the relation of the same to awns and stigmatic feathers, are recorded.

This hairiness manifests on the upper side of the leaf blade. The hairs are confined to about one-third its length from the tip. The hairs are spinescent, pointing in the direction of the tip of the leaf blade. They are usually about half to one millimetre in length and occur in rows along the veins. Towards the tip to which the veins converge, they get crowded. The flag, (the top-most leaf) shows this character best. In the leaves of seedlings under six weeks old this hairiness is not easily noticed. Hairiness is best seen in mature leaves about flowering time. In some varieties these hairs are deciduous; in others they persist even on dried leaves. There is a certain amount of variation in the manifestation of this character in pure lines. The hairs may be sparse and in some cases confined to the extreme leaf tips. In others, the hairs may be dense and extend to more than half the length of the leaf-blade. When the hairs are dense, the leaf-blades present a dullish green look. Against sun-light the hairs show off and glisten.

Among the sorghums, this character manifests in most of the following varieties; *S. durra* Stapf, *S. cernuum* Host, *S. caudatum* Stapf, *S. caffrorum* Beauv, and *S. nervosum* Bess. In *S. durra* the hairiness is sparse; in *S. caudatum* and *S. cernuum* the hairiness is dense. In the groups *S. Roxburghii* Stapf and *S. guineense* Stapf, this hairiness is absent with a few rare exceptions. Among wild sorghums leaf tip hairiness is met with in a few types of *S. sudanense* Stapf.

To pursue the inheritance of this character (which is so common) and its relationship to other plant characters, a cross was made between A. S. 60,

a variety of *S. durra* from Coimbatore and A. S. 4174, a variety of *S. Roxburghii* from N. Rhodesia. *S. Roxburghii* is noteworthy not only for the absence of hairiness on leaf tips but also for an absence of awns in the group and for a paucity of feathers at the tip of the stigma. It is mostly in this group that the basal feathered stigmas occur.[2] It may also be noted that in this group and in the allied *S. guineense* the glumes gape out and their edges roll in. The contrasting characters of the parents and the F_1 are presented in the following table.

TABLE I.

A. S. 60 × A. S. 4174

Character.	Parents A. S. 60	Parents A. S. 4174	F_1
Leaf tip	hairy	glabrous	hairy
Stigmatic feathers	fully feathered	basal feathered	fully feathered
Awn	long (5–7 mm.)	Nil	Nil
Leaf sheath	reddish purple	brown	reddish purple
Nodal band	glabrous	hairy	hairy
Grain colour	yellow with brown wash	white with red base	reddish brown

The F_2 and F_3 segregations for hairiness of leaf tip are given in table II.

TABLE II

Generation and family No.			Behaviour of progeny Leaf tip hairy	glabrous
F_2 A. S. 5420	...	...	146	45
,, 5421	...	...	131	37
F_3 A. S. 6292	...	...	168	60
,, 6293	...	...	175	62
,, 6294	...	...	168	57
,, 6295	...	...	181	66
,, 6296	...	...	205	75
,, 6297	...	...	160	52
Total of F_2 and F_3	...	...	1334	454

From the above table it will be noticed that a hairy leaf tip is a monogenic dominant to a glabrous tip.

The relationship between leaf tip hairiness and the awn is given in the following table.

TABLE III.

Generation and Family No.	Behaviour of progeny: Leaf tip hairy		glabrous	
	Awn Nil	long (5–7 mm.)	Nil	long (5–7 mm.)
F_2 A. S. 5420	107	39	38	7
,, 5421	104	27	32	5
F_3 A. S. 6292	115	53	48	12
,, 6293	126	49	51	11
,, 6295	123	58	53	13
Total	575	226	222	48
Calculated at a 43% cross over value	585	218·3	218·3	49·4
$X^2 = \cdot 5448$		$P > \cdot 90$		

The hairiness of the leaf tip is linked to the awn (5—7 mm.) with a cross over value of 43 per cent.

The relationship between leaf tip hairiness and the feathering of the stigma is given below.

TABLE IV

Generation and family No.	Behaviour of progeny: Leaf tip Hairy — Stigma Fully feathered	Leaf tip Hairy — Basal feathered	Glabrous — Fully feathered	Glabrous — Basal feathered
F_2 A. S. 5420	126	20	24	21
,, 5421	114	17	18	19
F_3 A. S. 6292	140	28	30	30
,, 6293	147	28	27	35
,, 6295	150	31	31	35
,, 6296	170	35	30	45
Total	847	159	160	185
Calculated at a 25% cross over value	865·4	147·8	147·8	190
	$X^2=2.4416$		P>·30	

Leaf tip hairiness and the feathering at the stigmatic top are linked with a cross over value of 25 per cent.

The relationship between hairiness of the leaf tip and the two organs, awn and stigma, being thus found out, the inter-relationship between awn and stigmatic feathering is given in the following table.

TABLE V.

Generation and family No.	Behaviour of progeny: Awn Nil — Stigma Fully feathered	Awn Nil — Basal feathered	Long (5—7 mm.) — Fully feathered	Long (5—7 mm.) — Basal feathered
F_2 A. S. 5420	106	39	44	2
,, 5421	100	36	32	0
F_3 A. S. 6292	107	56	63	2
,, 6293	120	57	56	4
,, 6295	116	60	68	3
Total	549	248	263	11
Calculated at 18% cross over value	544·2	259	259	8·8
	$X^2=1.1213$		P>·70	

There is a linkage between the awn and the feathering of the stigma with a cross over value of 18 per cent.

The hairiness of the leaf tip being so common, the relationship of this factor with characters other than those affecting the related homologous awn and stigma, are given in the following table.

TABLE VI

Other characters	Leaf tip Hairy		Glabrous	
Hairiness of nodal band	hairy	glabrous	hairy	glabrous
Total of six F_3 families	793	264	278	98
Expected 9 : 3 : 3 : 1 ratio	803·81	267·94	267·94	89·31
The P factor of leaf-sheath colour	purple	brown	purple	brown
Total of five F_2 and F_3 families	501	141	158	51
Expected 9 : 3 : 3 : 1 ratio	478·69	159·56	159·56	53·19
The W factor of grain pericarp colour	yellow	white	yellow	white
Total of four F_3 families	540	182	191	67
Expected 9 : 3 : 3 : 1 ratio	551·21	183·75	183·75	61·25

It will be seen from the above table that the hairiness of the leaf tip is, in inheritance, independent of hairiness of the nodal band, the P leaf sheath colour factor and the W pericarp colour factor.

The above cross has given the following additional independent inheritances in relation to the awn and stigmatic feathering.

TABLE VII

Other characters.	Awn Nil		Long (5—7 mm.)	
Hairiness of the nodal band	hairy	glabrous	hairy	glabrous
Total of four F_3 families	490	177	203	54
Expected 9:3:3:1 ratio	519·75	173·25	173·25	57·25
The P factor of leaf sheath colour	purple	brown	purple	brown
Total of three F_2 and F_3 families	338	94	110	29
Expected 9:3:3:1 ratio	321·19	107·06	107·06	35·69
The W factor of grain pericarp colour	yellow	white	yellow	white
Total of two F_3 families	257	82	104	32
Expected 9:3:3:1 ratio	261·19	89·06	89·06	29·69

TABLE VIII

Other characters.	Stigma Fully feathered		Basal feathered	
Hairiness of the nodal band	hairy	glabrous	hairy	glabrous
Total of four F_3 families	545	180	199	68
Expected 9:3:3:1 ratio	558	186	186	62
The P factor of leaf sheath colour	purple	brown	purple	brown
Total of three F_2 and F_3 families	381	101	119	38
Expected 9:3:3:1 ratio	359·5	119·8	119·8	39·9
The W factor of grain pericarp colour	yellow	white	yellow	white
Total of three F_3 families	413	138	152	52
Expected 9:3:3:1 ratio	424·69	141·56	141·56	47·19

The hairiness of the node is also independent of the awn and of the P factor of the leaf sheath colour, as will be seen from the following table.

TABLE IX

Other characters	Node			
	Hairy		Glabrous	
Awn	Nil	Long (5–7 mm.)	Nil	Long (5–7 mm.)
Total of four F_3 families	490	203	175	54
Expected 9 : 3 : 3 : 1 ratio	519·75	173·25	163·25	57·25
The P factor of the leaf sheath colour	purple	brown	purple	brown
Total of two F_3 families	278	95	92	27
Expected 9 : 3 : 3 : 1 ratio	276·75	92·25	92·25	30·75

Summary. Many of the sorghum varieties have spinescent hairs on the tips of their leaves on the top side. A few varieties (especially *S. Roxburghii* Stapf) have glabrous leaf tips. In crosses between these two types, hairiness on the leaf tip has proved a monogenic dominant. This hairiness is linked to the awn with a 43% crossover value and to the feathering at the tip of the stigma with a 25% cross over value. The awn is linked to the feathering of stigmatic tips with 18% cross over value. The hairiness of the leaf tip is independent in inheritance of the hairiness on the nodal band, the P factor of the leaf sheath colour and the W factor of pericarp colour. The awn and the feathering of stigmatic tops are each of them independent in inheritance of the hairiness of the nodal band, P of leaf sheath and W of grain pericarp. The hairiness of the nodal band is independent of P of leaf sheath and W of grain pericarp.

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SELECTED ARTICLE

Minor Elements in Fertilizer Practice

By Prof. F. MENCHIKOWSKY

When Liebig established in the fifties—sixties of last century the theory of mineral nutrition of plants, he added to the nitrogen, oxygen and carbon, found in the air and the water, the following fundamental elements found in the ash of plants: potassium, calcium, silicon and manganese (1). This list has undergone little change in the course of years; only two more elements were added, namely iron and sulphur (2). The above mentioned elements form a large proportion of the mineral wealth of the solid surface of our planet: O–47·17%, Fe–4·44%, Ca–4·79%; Mg–3·76%; K–3·00%; S–0·11%; P_2O_5–0·25%. It is therefore, only natural that these became the basis of mineral plant nutrition. They exist in the soil in the shape of the following minerals: felspars, calcite, dolomite, apatite, gypsum and quartz.

Early and Modern Physiological Theories. The lack of elaborate methods of chemical analysis was responsible for the fact, that up to quite recently only ten

elements were considered essential for plant nutrition (3). Even to-day we do not know as yet their exact number, but they are undoubtedly much more numerous. It is quite possible that all elements found in the ash of plants, and they number more than 30, play a more or less active part in the life of plants. Minor elements are only those that are found in infinitesimally small quantities in the ash of plants. At the present state of our knowledge it is very difficult to define the exact place and part of all minor elements in the processes of nutrition and development in plants but the importance of some of these grows clearer every day. During the last few years several cultivated plants have exhibited numerous physiological diseases, that can be cured by the introduction of infinitesimal quantities of manganese, zinc, copper, cobalt, boron or other elements into the nutritional solution or tissues of the plant organism.

How was discovered the part played by minor elements. Apart from the lack of appropriate progress in chemical practice, one of the factors, responsible for our ignorance concerning the role played by minor elements, was the predominant use up to a few years ago of natural manures, which contain always larger or smaller quantities of various mineral impurities among which are to be found also the minor elements. The astounding progress of chemistry and technical practices have led to the introduction of chemically pure fertilizers; these being much richer in soluble composition of N with K and P have ousted to a certain degree the use of natural pure products. The soil lost as a consequence of the disappearance of mineral impurities those minor elements, which play such an important part in plant nutrition according to our present time notions. The partial disappearance of these elements from our fertilizing practice was one of the causes, that brought about the appearance of new and hitherto unknown physiological diseases.

The amelioration of neglected soils leads to the discovery of the effect of minor elements. The use of chemically pure fertilizers, from which the minor elements have been removed by refining, did not cause any complications as long as these were applied only to fertile soils of a varied mineral composition. But as soon as these fertilizers were applied to poor soil, new diseases made their appearance. The latter, as we now know, are the result of the absence of any trace of such elements as manganese, copper, zinc and others. Thus, e. g., it was found that several of the minor elements are not present in the soils of Florida, which are but sand mixed with a small quantity of vegetable mould (humus). Sometimes, soil may be deficient of a larger proportion of one or another of the minor elements, depending on its geological origin.

The amelioration of a whole series of neglected soils in Northern Europe has revealed the existence of plant diseases known under the general title of reclamation diseases. One of these, namely 'Elana' is characteristic of sands, heaths and moorlands.

In Denmark this disease has been found on Calluna heath soil; a similar disease has made its appearance also in the ameliorated areas in Holland. This disease is successfully controlled by the use of town refuse, for the latter always contains traces of copper. The same reason was responsible for a speedy recovery following the addition of copper sulphate to the mineral fertilizer applied to the soil. C. S. Piper and his collaborators have recently shown that the so-called Coastal Sickness, observed among sheep in Southern Australia can be cured by increasing the fertility of pastures, as soon as copper salts are introduced into the soil (4).

The part played by minor elements in plant nutrition. Over and above those elements that, owing to their quantitative predominance, play a decisive

role in plant nutrition such as N, K, P, a group of minor elements have been lately assigned a peculiar position. Prominent among these are manganese, zinc, copper and boron. These elements, even when present in small quantities affect cultivated plants adversely but what is especially interesting is that their total absence is equally detrimental leading, as it does, to serious disturbances of the physiological activity of plants. Experiments carried out during the last 25 years show that it is possible to control various forms of physiological diseases by introducing into the general system of fertilization minimal quantities of the above mentioned elements. Already in 1911 Hudig (Holland) has demonstrated that oat spots could be cured by the introduction of manganese. Other Dutch scientists successfully fought physiological diseases of rye, oats, and horse beans grown in marshy soils with the help of copper salts. Boron proved an element especially valuable for the successful growing of tobacco, potatoes, beets and beans. Observations proved that the growth of sugar-cane was arrested whenever it developed in an environment deficient of boron. It then showed the symptoms of a serious disease namely 'pokkah-bong.' Maize is sensitive to the absence of manganese in the soil. These facts sufficiently prove that minor elements, which play such a role in the life of cultivated plants both in temperate and tropical countries should be taken into consideration on the initiation of a programme of nutrition and fertilization in our subtropical agriculture

Minor Elements in Citriculture. A very common disease of citrus plants known as 'mottle leaf' is not due to any infecting organism, but to the disappearance of chlorophyll from the leaves and arrested growth. If the disease is present in a mild form, one observes a decrease in the number of chloroplasts and a weakening of the photosynthetic activity of the leaves (5). In more serious cases the number of yellow leaves increases largely, while young leaves (of the new growth) grow smaller, not exceeding in very serious cases, 2·5 cms, in length. At the same time twigs dry up, frequently leading to the death of the whole tree. In some cases the disease attacks also the roots. The causes of this disease have been variousy diagnosed in the literature dealing with the subject: the presence of chlormein irrigation water (6) excess of urine in the manure, unbalanced K : Ca ratio. According to Johnston, however, the appearance of mottle leaf in a plant frequently coincides with the absence of zinc in its nutritional medium (7)

The use of zinc in the control of citrus diseases. The investigation of means to control mottle leaf revealed the fact that the use of manure brings about a weakening of the symptoms of this disease; the symptoms weaken even more when iron and zinc salts are used. W. H. Chandler, of the University of California, was the first to use Zn in the control of mottle leaf and little leaf in fruit trees. Before this iron sulphate was successfully employed in which was contained an admixture of zinc sulphate. On the advice of Chandler, Johnston also employed salts of zinc in the control of citrus diseases. The chemical used was zinc sulphate which was spread on the ground at a little distance round the tree. But the best results wers achieved, when zine sulphate admixed with some other substance was sprayed over the trees. Experiments made by Johnston in 1932–33 gave very positive results. In 1934–35, Parker carried out experiments to control mottle leaf in grapefruit (8). The trees were sprayed with a water mixture and albumin used as a medium. Trees which carried an average of 30% –40% of diseased leaves, not only recovered after treatment with zinc sulphate but also showed a marked increase of their general yield and an improved quality of fruit. Quantity of fruit by weight increased 199%, while the number of cases grew by 20·2%. Size, shape and rind of fruit improved in quality on trees treated with salts of zinc. Observation showed that grapefruit trees, the physiolgical activity of which has been seriously impaired by mottle leaf, react rapidly towards recovery on the admixture of zinc sulphate in their irrigation water.

The effect of boron on citrus trees. Haas and other research workers have proved, that though even small amounts of boron are detrimental to the health of citrus trees, yet infinitesimal quantities of the same elements are not only harmless to plants, but absolutely essential for their successful growth. Numerous experiments have shown that plants placed in an appropriate environment, but wholly deprived of boron revealed arrested growth and a series of pathological deviations. The following sickness symptoms were diagnosed as a result of boron deficiency in citrus plants (10) leaves curl up along the midrib; their colour turns brown or yellowish-green; midribs and veins develop a corky film which becomes detatched. Seriously affected plants grow multiple buds that die soon afterwards. The bark of branches (and in serious cases also that of the trunk) bursts in the internodes secreting an amber coloured gum. Roots turn brownish black, stop growing and die. Trees deprived of boron do not develop flowers and bear no fruit whatsoever. The internal anatomic and physiological changes in citrus trees revealed the character of these diseases on the inside. Cross sections show accumulation of gum in cambial parts, which disintegrate, this causing the separation of the bark from the xylem. Parts of the phloem become disorganised and the supply of sugar to the lower parts of the plants tops while it accumulates in the leaves. We are thus led to believe that in the absence of boron the tissues of citrus trees lose their ability to transform and transport the products of plant metabolism, the balance is shifted to one side, while toxic substances accumulate in the plant. As soon as one part per thousand of boron is introduced into the nutritive medium, not only new growth is stimulated, but the plant begins to recover generally. The secretion of gum stops, the sugar content of the leaves dropping simultaneously.

The Effect of Manganese Deficiency on Citrus Tree. Old literature abounds in references to the detrimental effect of even small quantities of manganese on plants. Loeb (1903), McCallum (II; 1913) and Branchley (1914) have shown that manganese is toxic even in a 1:100,000 ratio. Johnston (1917) opined that this effect is due to a lowered use of iron. On the other hand numerous experiments proved that the application of salts of manganese brings about increased fertility (especially in calcareous soils). Further investigations of the subject showed (12), that an admixture of manganese (1:5,000,000—1:10,000,00) favourably affects the growth of plants; on the contrary, green cells deprived of manganese are subject to autolysis, finally dying. Neither iron nor manganese are compound parts of chlorophyll, but both act as catalysers in the formation of the chlorophyll nucleus. The first symptoms of citrus diseases consequent on the lack of manganese were discovered, when citrus seedlings were grown in sand and water solutions into which iron had been introduced as a chemically pure substance (13).

Before such pure salts were used, no pathological symptoms had been noticed, for the usual compounds of iron introduced into the solution contained also an admixture of compounds of manganese. Observations carried out on citrus shoots grown in water solutions, that contained all necessary nutritive compounds with the exception of manganese, showed the following results; lemon twigs experienced great difficulty in their growth. The loss of leaves and even twigs prevented maximal development. In spite of liberal supplies of iron, leaves turned a chlorotic colour, as if no iron at all was available. But leaves never showed spotted colours. Both sides of leaves revealed gum spots, especially in the vicinity of midribs. Dead twigs showed gum-swellings, which secreted gum. Roots, however, remained healthy. As soon as a suitable proportion of manganese salts were introduced into the solution, plants recovered rapidly.

Exanthema and copper deficiency in citrus trees. Exanthema (die-back), which is a very common disease in Florida, is also considered a result of unsatisfactory plant nutrition, for the majority of Floridan soils is nothing but sand with a

slight admixture of organic matter (O. C. Bryand). The symptoms of this well known disease are gum pockets near the nodes, stained shoots and fruits, abundant growth of multiple buds, a very dark green colouration of leaves and an abnormal shape of the latter. Ozerkowsky and Thomas pointed out that copper deficiency is the cause of this disease in pear trees (14) Haas and Quale came to the same conclusion with regard to citrus trees (15). According to the latter investigators the leaves of affected trees show a decrease of the content of copper, while absolutely healthy trees, or such that have been attacked and are on the way to recovery following a treatment with copper salts, show an increase of the content of copper. A similar decrease of copper content was also found in the fruits of affected trees. Copper is, therefore, an essential factor for the health of citrus trees; a deficiency of this element brings about symptoms of exanthema.

Local soils and minor elements. The participation of minor elements in the nutrition of plants depends both on the proportion of the applied fertilizers as well as on the chemical composition of the soil. Local practice which prescribed an abundant use of organic manures in citrus plantations, had the additional advantage of introducing a sufficient quantity of minor elements, which were to be found in manure fertilizers. As the use of organic manure lessened from year to year ceding its place to highly refined mineral compositions, the situation changed, creating conditions favourable to arrested growth consequent upon a deficiency of minor elements. The data quoted above show, that poor sandy soils as well as ameliorated marshy soils do not as a rule contain these minor elements; this deficiency leads to the physical diseases enumerated above. The majority of our soils in the coastal zone belongs to the class of poor sandy soils. The above mentioned unfavourable change in fertilizing practice makes the plants dependent on these poor soils and leads to a corresponding unfavourable change in the conditions of growth and development. The problem of minor elements is important also in soils of other zones, as e. g. in the Jordan Valley, where an excess of calcium salts in the ground brings about the elimination of iron and manganese salt from the soil solution. In all cases of amelioration of marshy soils for purposes of growing citrus and other fruit trees or cultivated plants, proper attention should be paid to the role of minor elements in plant nutrition.

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EXTRACT

Cinchona Cultivation in South India.

Species :—

(a) *Cinchona Ledgeriana* and its hybrids. This is the most valuable of the cinchona barks, having a high quinine sulphate content and low febrifuge alkaloid content but it has however the disadvantage of being a shortlived variety. It grows best at an elevation of from 3,000 to 4,000 feet.

(b) *Cinchona officinalis, uritusinga*, etc. These varieties are much easier to grow, having a long life but maturing rather more slowly than the other varieties. They grow best at an elevation of from 6,000 to 7,500 feet.

(c) *Cinchona robusta* and hybrids. These varieties are robust, relatively quick-growing and long lived. They grow at elevations of from 3,000 to 6,500 feet.

(d) *Cinchona succirubra*. The easiest variety to grow, doing well at elevations from 3,000 to 6,000 feet. The bark of this variety is usually used for pharmaceutical purposes and is of no manufacturing value unless cinchona febrifuge is required. The market demand for this variety of bark is relatively small.

Conditions for cultivation of cinchona. Favourable conditions for cinchona areas are undulating virgin jungle or reafforested lands, good drainage and a well distributed rainfall of between 40 and 100 inches per annum. Adverse factors are frost, exposure to wind, long periods of drought, lack of shade or shelter trees when plants are young and an excess of shade or shelter trees once the cinchona is well established.

Seed nurseries. From an ounce of cinchona seed, 4,500 plants should be obtained without difficulty. The seed must be sown under *pandals*, and one ounce of seed is required for not less than twenty feet length of a three to four feet wide seed bed. The ground to be used for these beds should be thoroughly cleaned and well dug to a depth of about two feet. The prepared ground may be subsequently covered with fresh jungle soil mixed with clean sand, the centre of the bed being slightly higher than the sides.

For watering the seed beds a fine spray is most important as excessive moisture invariably causes "damping off". Seeds will germinate in two or four weeks and great care must be taken to maintain uniform conditions. Direct sun's rays on germinating and young seedling beds are definitely harmful, yet proper ventilation is essential. Unless overcrowded, seedling can be left to attain the height of one inch before transplanting.

Field nurseries. Seedling may be transplanted direct into plant baskets for later field planting or, as is more usual, put out into field nursery beds four inches apart. These beds, which should be raised above ground level, can be

open or covered with *pandals* according to local conditions. The open beds are fern shaded in earlier stages. Before the plants are planted into the field they should have been hardened off by gradual exposure and decrease of watering. The plants should have a good root system, woody stems and be from 9 to 15 inches in height. For successful field planting the nursery beds must first be well-watered and plants then removed with a good surround of earth.

Experience has shown that early planting (i. e. as early as possible before the heavy rains) gives most satisfactory results especially in areas occasionally subject to a long and hot dry season.

Planting out. After clearing the area to be planted, pits (usually 1½ feet deep) are dug four feet apart. Pits dug during the dry weather should be filled after the first showers when planting can be commenced. At this stage shade trees can be interplanted sixteen to twenty feet apart.

Cultivation. Cinchona yields very readily to cultivation and manuring with cattle or green manures. Precocious flowers or seed pots should be removed when they occur and pruning where necessary should have as its objective a tree with a good single stem. It should hardly be necessary to add that forking is most benefical and worth the extra expense. Absolute clean weeding in the very dry weather should not be undertaken.

Pests and diseases. Careful upkeep and improvement in cultural conditions is the best safeguard against disease. Various mould diseases and *Helopeltis* occasionally occur. The more serious mould diseases are best dealt with by cutting away the affected parts or complete removal of the trees. Ruthless rejection of sickly seedlings and nursery plants will do a great deal to ensure a healthy and successful plantation.

Harvesting. Apart from pruning and removal of sick trees there are two methods of harvesting cinchona, namely, coppicing or uprooting. The former is only recommended for hardy varieties. Considerable wastage of bark is avoided if saws are used instead of axes for felling and cutting up the tree prior to barking, which is done with pruning or bark knives.

Great care should be taken in the collection of root bark as approximately 25 per cent of the total bark of a tree is usually classified as root bark and the value of this bark is higher than that of stem if total alkaloids are taken into account. Bark collected from prunings and subsidiary stems of young trees will not be as valuable as that from the stem of a mature tree.

Similarly branch bark has a lower value than that from the main stem—the quinine content of the bark decreases towards the branches and branch ends. Dead bark and wood chips contain no quinine and their presence in harvested bark adversely affects the bark value.

Bark for manufacturing purposes need not be of any specific size, but it should be free from stones, sand and earth as well as wood chips.

Sale of bark for manufacturing purposes. Cinchona bark is bought according to the percentage of quinine it contains. Of recent years the Government of Madras have also paid for some of the febrifuge yielding alkaloids. A certain price is fixed upon per unit which means 1 per cent. of quinine sulphate or other alkaloid per one pound of cinchona bark. This price has varied but has remained constant for some years now; namely, 1⅝ annas per unit of hydrated quinine sulphate. In addition ⅛ anna per unit of cinchonidine and cinchonine alkaloids combined has recently been paid.

Although the Cinchona Department has in the past been only too willing to purchase all cinchona bark of manufacturing quality offered to it by local planters, it must be understood that Government do not guarantee purchase of all

cinchona bark likely to be grown by private enterprise. Production at the quinine factory is regulated by the demand of the market it serves.

Private enterprise. In order to assist local private enterprise Government will be pleased to allow persons who own plantations and those who are anxious to grow cinchona to visit their plantations. Such visits will be allowed on Mondays or Fridays between 10 a. m. and 12 noon on permits to be obtained from the Director, Madras Cinchona Department, Ootacamund. The plantation officers will receive these visitors and will give them such general advice as appears necessary to meet individual requirements. *Planters' Chronicle*, Vol. 24, (1929): No. 4.

Gleanings.

Milk Production Costs. The third year's working of the Milk Investigation scheme for England and Wales is reported by the Agricultural Economics Research Institute, Oxford, and deals with the 1936-7 milk contract period. This report shows that the cost of production on 437 wholesale farms was 9·55d. per gallon; these figures show an increase of a third of a penny per gallon over the previous contract period, and are not inclusive of any allowance for interest on capital, transport costs, etc. The report also states that in many cases rises in wage rates were counteracted by the installation of milking machines. (*Rural Electrification and Electro-farming* Vol. XIV. No. 167).

World's Milk yield record Broken. Messrs. Wort and Way, of Red House Farm, Amesbury. Wiltshire, are the proud possessors of "Cherry" the now famous Shortorn cow, who recently broke the world's milking record with a yield of 38,678 lb in 366 days, thus eclipsing the record previsously held by Terling Graceful 10th, a British Friesian, in the herd of Lord Rayleigh. Cherry is expected to reach 40,000 lb. by Easter. (*Rural Electrification and Electro-Farming* Vol. XIV. No. 167).

Camphorated Coconut Oil Popularised. During the Malarial Epidemic of 1935, an officer of the Medical Department discovered the solubility of camphor in coconut oil and used camphorated coconut oil for cases of pneumonia, asthma and bronchitis with successful results. The effects of camphorated coconut oil not being differant from camphorated olive oil, the coconut Board gave publicity to this matter and has considerably increased the use of coconut oil for this purpose in 1937 and later. (*Journal of Coconut Industries, Ceylon*, p. 301).

Coconut Paper Research Subsidised. Mr. S. R. K. Menon, a research worker from Travancore, made representations to the Board as regards an invention which he had elaborated with reference to the manufacture of paper pulp from coconut husk. The Board held a special meeting at which persons interested in the Coconut Industry were present and at which Mr. Menon explained the nature of his invention. It was generally accepted that there were two elements in his invention which were original and constituted an advance on previous attempts, viz. (1) separation of fibre from the husk by a chemical instead of a mechanical process, and (2) disintegration of fibre into paper pulp by raising the temperature of the disintegrating solution to a higher degree than the one generally adopted hitherto in the manufacture of paper pulp. At a meeting of the Board held on the 20th of December, the Board resolved to co-operate with the Coconut Research Scheme in affording facilities to Mr. Menon to pursue his investigations as regards the commercial possibilities of his invention and offered a maintenance allowance of Rs. 150 per month for Mr. Menon and Rs. 15 per month to an assistant and a travelling allowance for Mr. Menon for travelling, if necessary, for the above investigations. The Coconut Research Scheme has given Mr. Menon the necessarv laboratory facilities for carrying on his investigations. It is expected that a success of the investigations will ensure a

new source of income to the Coconut Industry. *(Journal of Coconut Industries, Ceylon*, 2; p. 301—303).

Artificial Silk made from Cotton Linters. The Indian Central cotton Committee has been carrying on experiments in the first stage of artificial silk production by the acetate process and is determining the cost of producing chemical cotton from cotton linters, of which it is believed about 10,000 tons are now annually wasted in ginning and spinning. (*Tropical Agriculture* Vol. XVI. No. 4.)

Agricultural Jottings.

(From the Director of Agriculture, Madras)

MAHALI OR KOLEROGA DISEASE OF ARECANUTS

The areca cultivators are now aware that the most serious disease with which they have to contend is the *Mahali* or *Koleroga*. As the disease appears only after the outbreak of the monsoon, and as the measures taken for its control are only preventive, preparations should be started forthwith for having the gardens sprayed before the monsoon. On no account should spraying be given up assuming that the disease is not likely to appear this year. Growers should bear in mind that when once the disease breaks out in a garden, it is impossible to save the entire crop. Any number of sprayings given after the appearance of the disease can never equal in efficiency to the two sprayings given one just before the onset of the monsoon and the other about six weeks later.

Crop and Trade Reports.

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 16th June 1939 amounted to 2,91,312 bales of 400 lb. lint as against an estimate of 388,900 bales of the total crop of 1938-39. The receipts in the corresponding period of the previous year were 2,43,346 bales. 2,17,077 bales mainly of pressed cotton were received at spinning mills and 96,194 bales were exported by sea while 99,322 bales were imported by sea mainly from Karachi, Bombay and Egypt. *(From the Director of Agriculture, Madras).*

College News and Notes.

Students' Corner. The College re-opened on the 15th instant and students of the 2nd and 3rd year classes have assembled after the vacation.

Personal. We are glad to note that Rao Bahadur G. N. Rangaswami Ayyangar, F. N. I., I. A. S., has been elected as a member of the Council of the National Institute of Science of India, Calcutta, for the year 1939.

Birthday Honours. We are glad that Sri. K. Gopalakrishna Raju, Provincial Marketing Officer, Madras, is honoured with the title of 'Rao Bahadur' in the recent Birthday Honours. We offer our congratulations to him.

Committee on Co-operation. The Committee on Co-operation consisting of the following members met at the Freeman Hall of the Agricultural College on the 9th and held their sittings here till the 20th instant.

Members of the Committee on Co-operation. Sir T. Vijayaraghavacharya (Chairman); Dewan Bahadur Sri. T. A. Ramalinga Chettiar, M.L.C. (Vice-Chairman); Abdur Rahman Khan Sahib Bahadur, M. A., B. L., M. L. A., Sri. K. Bashyam, B.A., B.L., M.L.A.; Diwan Bahadur Sri. K. Deivasikhamani Mudaliar, M.L.C.; Rao Bahadur Sri. M. Giriappa, B. A.; Sri. Kala Venkata Rao, M. L. A.; Sri. A. Karunakara

Menon, B. A., B. L., M. L. A,; Sri. V. Kurmayya B. A., LL. B., M. L. A. ; Sri. K. A. Nachiappa Gounder, M. L. A. ; Sri. B. Pattabi Sitharamiah ; Hon'ble Sri. V. Ramadoss Pantulu, B. A., B. L. ; Diwan Bahadur Sri. C. S. Ratnasabhapathi Mudaliar; Sri. N. Satyanarayana ; Sri. M. Shiva Rao; Sri. J. Sivashunmughan Pillai, M. L. A.; Dr. P. J. Thomas, M. L. C. ; Sri. R. Suryanarayana Rao ; Sri. P. N. S. Ayyar, B. A. ; and Sri. S. A. Venkataraman, I. C. S., Registrar of Co-operative Societies ; Sri. B. S. Murthy, Parliamentary Secretary and Sri. K. Subrahmanyam Nayudu, M. A., Secretary to the Committee on Co-operation.

Visitors. Most of the members of the above committee on Co-operation, including the two honorary visitors, Messrs. A. Karunakara Menon and K. A. Nachiappa Gounder, availed of this opportunity to visit the Research Institute and the Agricultural College.

A batch of post-graduate students of the Imperial Dairy Institute, Bangalore, under the charge of Mr. K. Desai, Supervisor, visited the College Dairy on the 9th instant.

Mr. P. H. Rama Reddy, the Director of Agriculture, Madras arrived here on the 16th inst. on his way from Ooty to Madras and left this on the 17th instant. He revisited the College on the 22nd and left for Madras on the 27th instant.

The members of the Agricultural College Selection Committee consisting of the Director of Agriculture, Madras ; the Principal, Agricultural College, Coimbatore ; Sri. K. P. Mallikarjunudu, M. L. C. Advocate, Masulipatam ; Sri. R. Venkatasubba Reddyar, M. L. A., Advocate, Tindivanam ; Janab P. I. Kunhammad Kutty Hajee, M. L. A. Vice-Chairman, Calicut Municipality ; and Sri. J. Siva Shanmugam Pillai, M. L. A., interviewed the candidates for admission into the Agricultural College on the 22nd instant.

Address Sri. B. Pattabi Sitharamiah addressed the members of the Madras Agricultural Students' Union at 4 p. m. on 17—6—'39, at the Freeman Hall under the Presidency of Mr. R. C. Broadfoot, Principal and President of the Union. Answering questions put by some of the members, he gave his experiences and views on farming, He requested the students to study rural problems and help the down-trodden people. In winding up the proceedings, the Principal and President of the Union asked the students to keep their eyes open, and after studying the rural problems, help in the improvement of agriculture.

Association of the Upper Subordinates. The Secretary of the Association of Upper Subordinate Officers of the Madras Agricultural Department writes under date 21st June '39 :— "The Annual general body meeting of the Association of the Upper Subordinate Officers of the Madras Agricultural Department will be held during the "College Day Week" in the month of July 1939. All members of the Association are invited to be present at the function ".

Students' Club. At the first General Body Meeting of the Students' Club held on 24—6 '39 with Mr. M Kanti Raj, the Vice-President, in the Chair, the following students were elected as office-bearers of the Students' Club for the year 1939-40.

M. Mohan Punja	General Secretary.
K. Narayana Rao	Games Secretary.
R. Veeraraghavan	Tennis Captain.
Daniel Sundararajan	Hockey ,,
D. Narasimhamurthy	Foot-ball ,,
K. M. Somanna	Cricket ,,
M. U. Bhaskar Rao	Badminton ,,
K. S. Ramaswami	Volley-ball ,,
Noel Sreshta	Representative for class III.
S. N. Ramasubramaniam	,, for class II,

The Late Rao Bahadur D. Balakrishnamurthi.

The Readers of the Journal will be sorry to learn of the demise, on Sunday, the 18th June, at Mukkamala, Ambajipet Post, East Godavari District, of Rao Bahadur D. Balakrishnamurthi, Retired Deputy Director of Agriculture, Madras Presidency, at the age of 67. The late Mr. Murthi was an alumnus of the Rajahmundry College. He later joined the Madras College of Agriculture at Saidapet in July 1898 where he took his diploma. He joined service on 18th September 1901 and was in the first batch of agricultural probationers selected for training in the Government Farms in the Bombay Presidency. On return he was first posted as Agricultural Inspector in charge of the Sugarcane Station at Samalkota and was later at Palur in South Arcot District in the same capacity. He was placed on special duty in connection with the Sugarcane enquiry in Madras which led to the organisation of a Sugarcane Station, first in this Province and subsequently, of a Sugar Department on an all-India basis, which since won world-wide distinction. At intervals he was selected for special duty in connection with the Palm disease operations in East Godavari district and the supply of indigo seed to the ryots in the Vizagapatam district during the Great War. He became the Assistant Director of Agriculture, Northern circle, on 3—12—1915 and was one amongst the first four Indians to whom the portals of the Indian Agricultural service were thrown open in 1921-22, his promotion to the Indian Agricultural service dating from 29th October 1921. He served in most of the districts of the Madras Presidency. He was professor of Agriculture and Superintendent, Central Farm, from 29th June 1922 till 25th May 1925. For a second time also, between 7th March 1927 and 21st May 1928, he served in the same capacity. For his services to Government he was created a 'Rao Bahadur' while he was the Dy. Director of Agriculture, Guntur, in 1930. A man of strong personality, he was industrious, and courageous in facing difficulties. After his retirement from service, from 16th December 1931, he spent his time and talents amongst the ryots and his kinsmen at Mukkamala.

We offer our sincere condolence to the members of the bereaved family.

Weather Review—MAY 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st	Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·3	−1·7	1·7	South	Negapatam	4·7	+2·1	17·6
	Calingapatam	0·2	−2·4	1·1		Aduthurai *	3·4	+1·4	16·4
	Vizagapatam	0·2	−1·8	2·9		Madura	2·4	−0·5	12 1
	Anakapalli*	0·5	−1·9	2·1		Pamban	2 8	+2·0	8·3
	Samalkota*					Koilpatti*	0·5	−1 4	5·9
	Maruteru*	0·0	−1·4	1·4		Palamkottah	1·0	−0·6	5·0
	Cocanada	0·1	−1·9	2·8					
	Masulipatam	0·0	−1·3	0 5					
	Guntur*	0·6	−1·6	1·5	West Coast	Trivandrum	7 8	−0·7	15·9
						Cochin	8·5	−3·2	22·1
Ceded Dists.	Kurnool	0·0	−1·1	0·6		Calicut	3·0	−5·5	10·0
	Nandyal*	0·1	−1·3	0·5		Pattambi *	0 0	0·0	0·0
	Hagari *	0·3	−0·7	0·6		Taliparamba *			
	Siruguppa*	0·1	−1·5	0·2		Kasargode *	0·2	−8·2	3 9
	Bellary	0·9	−1·1	2·2		Nileshwar*	0·3	−8·9	2·8
	Anantapur	0·2	−1·9	2 7		Mangalore	0·0	−6·2	5·0
	Rentachintala	0·1	...	0·5					
	Cuddapah	0·0	−1·6	1·7					
	Anantharaju-pet *	0·0	−1·1	5·7	Mysore and Coorg	Chitaldrug	0 1	−2·9	4·8
						Bangalore	2·0	−2·4	9·1
Carnatic	Nellore	0·0	−0·8	4·0		Mysore	5·8	+0·6	9·0
	Madras	0·0	−1·1	6·2		Mercara	0·4	−5·3	2·8
	Palur *	0·7	−1·2	12·5					
	Tindivanam *	0 6	−0 9	6·8					
	Cuddalore	2·3	+1·6	16·0	Hills	Kodaikanal	1·7	−4·3	16·8
						Coonoor			
Central	Vellore	1·0	−1·3	8·6		Ootacamund *	4·9	−2·3	10·4
	Salem	3·8	−0·9	11·0		Nanjanad *	2·0	−3·2	6·4
	Coimbatore	0 7	−1·7	4·7					
	Coimbatore A. C. & R. I.*	0 6	−2·0	4·3					
	Trichinopoly	3·3	+0·3	10·8					

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette.

Associated with a temporary advance of the monsoon in the South East Arabian Sea on the 9th which weakened on the 12th and in the South Bay of Bengal on the 11th which continued to be active till the 21st, general rain has occurred in Malabar and scattered thunder showers in South East Madras and Mysore.

Skies were moderately to heavily clouded in South Madras, Mysore and the Madras Deccan; lightly to moderately clouded in Konkan and Malabar; and clear or lightly clouded elsewhere. Humidity was in defect in the Bombay Deccan and Hyderabad. Maximum temperatures were above normal in the Bombay Deccan and Hyderabad. Rentichintala and Cocanada recorded 114°F on the 29th and 30th instants respectively.

Rainfall was in large defect in all places except parts of the Carnatic and southern districts.

Chief amounts of rainfall.

Negapatam	3·4" on 7th.
Cochin	2·2" on 8th.

Weather Report of the Agricultural College & Research Institute Observatory.

Report No 5/39.

Absolute Maximum in shade	93·5°F
Absolute Minimum in shade	68·5°F
Mean Maximum in shade	95·9°F
Departure from normal	+0·9°F
Mean Minimum in shade	74·0°F
Departure from normal	Nil.
Total rainfall for the month	0·63"
Departure from normal	-2·0
Heaviest fall in 24 hours	0·20"
Number of rainy days	4
Mean daily wind velocity	3·6 m. p. h.
Departure from normal	Nil.
Mean humidity at 8 hours	67·9%
Departure from normal	-2·3%

Summary. Usual hot weather conditions prevailed during the month. The skies were moderately to heavily clouded with frequent thunder and lightning. The mean maximum temperature was above normal, while the mean minimum was normal. The mean humidity was below normal. The rainfall for the month was 0·6" which was far below normal. P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notification.

1. Transfers.

Name of officers.	From	To
Sri E. Kunhappa Nambiar,	Offg. A. D. A., Tinnevelly,	Offg. A. D. A., Madura.

2. Leave.

Name of officers.	Period of leave.
Sri V. T. Subbiah Mudaliar, A. D. A., Tirupattur.	L. a. p. for 17 days from 1—6—1939.

Subordinate Services.

1. Posting.

The following officiating appointments in the III Grade have been ordered from 21st June 1939.

Name of officers.	Posting.
Sri B. M. Pinto.	Offg. A. D., Hospet.
„ J. Gopal Rao.	Offg. A. D., Nellore.
„ R. Shanmukasundaram	Offg. F. M., D. F. S., Hagari.
„ D. Rama Rao.	Offg. F. M., D. R. S., Hagari.
„ S. Lakshminarayana Pantulu	Offg. A. D., Nandyal.
„ K Satyanarayanamurthy.	Offg. A. D., Madanapalle.
„ K. Purushotham.	Offg. A. D., Anantapur.
„ N. Venkayya.	Offg A. D., Kavali.
„ J. V. Suryanarayana.	Offg. A. D., Rajampet.
„ R. H. Krishnan.	Offg. A. D., Sriperambudur.
„ C. Hanumantha Rao.	Offg. F. M., A. R. S., Siruguppa

2. Transfers.

Name of officers.	From	To
Sri R. Anantapadmanabha Pillai,	A. D., Nandyal,	A. D., Mudukalathur.
,, B. N. Padmanabhan,	A. D., Bellary,	A. D., Gingee.
,, G. Doraiswami,	Offg. F. M., Siruguppa,	A. D., Ariyalur.
,, S. Mahadeva Ayyar,	A. D. under training at Kodur,	A. D., Kodaikanal.
,, A. Krishnaswami Iyer,	A. D , Kodaikanal,	A. D., Madura.
,, T. Gopalan Nair,	A. D. under training at Kodur,	F. M., A. R. S., Taliparamba.
,, K. Rajabapanaiah,	A. D. under training at Kodur,	F. M., Guntur.
,, V. S. Rangacharlu,	F. M., Guntur,	A. D. under training at Bellary.
,, S. Kanakaraj David,	Offg F. M., D. F. S., Hagari,	Asst. in Paddy, A. R. S., Pattambi.
,, K. Meenakshisundaram,	Offg. F. M., D. F. S., Hagari.	A. D., Dharmapuri.
,, K. Venkataswami,	Offg. A. D., Madanapalle,	A. D , Palladam.
,, C. Annamalai,	F. M. under training at Kodur,	A. D., Puthur.
Janab Muhammad Ali Saheb,	A. D., Puthur,	A. D., Gudiyattam.
Sri S. Kuppuswami Ayyangar,	A. D. (on leave),	A. D., Saidapet.
,, T. K. Mukundan,	A. D., Cannanore,	Offg. F. M., Central Farm, Coimbatore.
,, L. Neelakantan,	Asst. in Cotton, A. R. S., Nandyal.	Asst. in Cotton, A. R. S., Koilpatti.
,, S. Mayandi Pillai,	Asst. in Cotton, A. R. S., Koilpatti,	Asst. in Cotton, A. R. S., Nandyal.
,, R. Krishnamurthi,	Offg. Asst. in Cotton, A. R. S , Koilpatti,	Asst. in Cotton, A. R. S., Nandyal.
,, M. L Balasundaram,	Offg. Asst. in Paddy A. R. S , Maruteru,	Offg. Asst. in Paddy, A. R. S., Buchireddipala.
,, M. C. Menon,	A. D., Tirupathur,	A. D., Cannanore.
,, M. Gopala Unnithan,	A. D. (on leave),	A. D.. Tirupathur.
,, M. K. Gopalan,	A. D., Proddatur,	Sugarcane Grower's Co-operative Union, Hospet.
,, A. K. Annaswami Ayyar,	F M., L. R. S., Hosur,	III circle, Tinnevelly.

3. Leave.

Name of officers.	Period on leave.
Sri B. L. Narasimham, A. D. Narasarapet.	L. a. p. for 13 days from 5--6--39.
,, K. C. Thomas, Offg F. M., Central Farm, Coimbatore.	Extension of leave, without allowances for one year from 12—6—39.
,, K. L. Ramakrishna Rao, Asst. in Cotton, A. R. S , Koilpatti.	L. a. p. for 15 days from 5—6—39.
,, P. V. Samu Ayyar, A. A. D. (on leave).	Extension of l. a. p. on m. c. for 3 weeks from 6—6—39.
,, K. Ramaswami Ayyar, A.D., Palladam.	L. a. p. for 3 months from 5—6—39.
,, R. Venkataramana Ayyar, A. A. D. (on leave).	Extension of l. a. p. for 3 weeks from 29—5—39.

Sri C. Annamalai, F. M. under training at Kodur.	L. a. p. for 1 month and 1 week from the date of relie
,, M. Kalimuthu, Teaching Asst. Coimbatore.	L. a. p. for 13 days from 2—6—39.
,, R. Narasimhachariar, A. A. D., Entomology.	L. a. p. for 1 month from 1—6—39.
,, M. Kandaswami, A. D., Koilpatti.	L. a. p. for 1 month from the date of relie
,, P. V. Hariharan, Asst. in Millets (on leave).	Extension of l.a.p. on m. c. on ½ averag pay for 6 months from 11—4 -39.
,, K. V. Seshagiri Rao, A. A. D., Atmakur.	Extension of l. a. p. for 1 month from 8—6—39.
,, C. Vadamalai, A. D., Hindupur.	Earned leave for 2 months from 1-6-39
,, C. A. S. Ramalingam Pillai, A. A. D., Ariyalur.	Extension of l. a. p. on m. c. for 2 months from 21—5--39
,, P. Kesavanunni Nambiar, A. D. (on leave).	Extension of l. a. p. for 1 month.
,, S. Ramachandran, Rice Research Station, Buchireddipalayam.	L. a. p. for 3 months and 15 days from the date of relief
,, M. K. Swaminatha Ayyar, A. D., Dindigal.	L. a. p. for 1 month from 19—6--39.
,, K. Govindan Nambiar, F. M., A. R. S., Taliparamba.	L. a. p. for 4 months from the date of relief
,, V. G. Venkataramana Rao, A. D., Palmaner.	L. a. p. for 17 days from 14—6—39.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during May 1939.

A. Books.

1. *Soils and Soil Management.* Millar, C. F. (1937). 2. *Geology of India.* Wadia, D. N. (1939). 3. *Paddy Breeding (Collections of reprints of Scientific articles).* Ramiah, K. (1936). 4. *Cotton.* Brown, H. B. (1938). 5. *Report on the Prospects of Cinchona cultivation in India.* Wilson, A. & Mirchandani, T. J. (1939). 6. *Report on the cost of production of crops in the Principal Sugarcane and Cotton Tracts in India.* Vol. 1—Punjab. (1938). Vol. 2—Bombay. (1938). Vol. 3—United Provinces. (1939). Vol. 8—Sind. (1939).

B. Annual Reports of Agricultural Departments & Agricultural Stations.

1. Madras Agricultural Station Reports, 1937—1938. 2. New Delhi Agricultural Research Institute Scientific Reports, 1937—1938. 3 & 4. Bengal Agricultural Department Annual Reports in 2 parts, 1937—1938. 5 & 6. Central Provinces and Berar—Agricultural Department Report on Demonstration work in the Eastern Circle, 1937--1938 and in the Southern Circle, 1937—1938. 7. Ontario Agricultural Department Annual Report, 1937—1938. 8. Madras Co-operative Department—Administration Report, 1937—1938.

C. Bulletins Etc.

9. The progress of Agricultural Science in India during the past twenty-five years—G. W. Burns (I. C. A. R. Miscellaneous Bulletin 26). (1939).

D. New Periodicals.

1. Journal of the American Society of Farm Managers and Rural Appraisers.

The Madras Agricultural Journal.
(ORGAN OF THE M. A. S. UNION)

Vol. XXVII.] JULY 1939 [No. 7.

THE TWENTY-EIGHTH COLLEGE DAY AND AGRICULTURAL CONFERENCE, 1939.

The twenty-eighth College Day and Conference organised by the Madras Agricultural Students' Union came off this year between the 13th and 16th July. The Conference was held in the spacious quadrangle of the Research Institute under the chairmanship of the Hon. Mr. V. V. Giri, Minister for Industries and Labour with the Government of Madras. At 12 noon on the 13th July, the students of the college presented a guard of honour to the distinguished president who was received at the entrance by Mr P. H. Rama Reddy, Director of Agriculture, Mr. R. C. Broadfoot, President and other office bearers of the Union. The hall was packed to overflowing with several members of the non-official public, officers of the department from far and near and the past and present students of the college. Among notable visitors were Sri. M. Bapineedu, Parliamentary Secretary, Sri. V. C. Vellingiri Gounder, Sri. V. C. Palaniswami Gounder, M. L. A., Sri. V. K. Palaniswami Gounder, M. L. A., Sri. K. Subramaniam, Chairman of the Coimbatore Municipal Council, Sri. A. Kanniah, B.A., B.L., Landlord and President, Roads Committee, Chittoor District Board, Sri. P. V. Hanumantha Rao, Landlord and Horticulturist, Panyam and Rao Bahadur Arulanandam Pillai, Retired Deputy Collector.

Mr. R. C. Broadfoot, Principal and President of the Union, welcomed the distinguished gathering in a neat little speech wherein he emphasised the importance of co-ordination between the Industries and Agricultural departments.

Several messages received from patrons, members, friends and well-wishers of the Union who were unable to be present at the Conference but wishing it every success, were read.

This was followed by the reading of the annual report of the activities of the Union by the secretary.

The Hon. Minister then gave away the prizes and medals won by the students of the college during the last academic year.

The Hon'ble Minister then delivered his presidential address which was listened to by the audience with rapt attention. In his speech he laid emphasis on the opportunities that lay ahead of the agricultural graduates

for service in the villages and the need for fostering cottage industries as an aid to agriculture. He exhorted the students of the college to think in terms of service to the people rather than service under the Government.

Fifteen papers covering a wide variety of subjects of agricultural importance were presented to the Conference. One pleasing feature was that as many as four papers were contributed by extra-departmental people. The papers evoked a great deal of discussion in which the departmental officers and non-official public took a lively interest thus contributing to a correct understanding of different view points.

The president, in winding up the proceedings, congratulated the Union and its members on the high quality of the papers presented and the standard of discussion which followed. He regretted that for want of time some of the papers could not be read and hoped that their publication in the *Madras Agricultural Journal* would make them available to a larger circle of agriculturists. In conclusion he complimented the Department on the work turned out and expressed the hope that it deserved the support of Government in every possible manner.

The Director of Agriculture, Mr. P. H. Rama Reddy, in proposing a vote of thanks to the Hon Minister said that he would bear in mind the proposal of Sri. T. V. Rajagopalachariar with regard to the utilization of temple lands and hoped that the graduates would not fail to take the opportunity to come forward and respond to the call. He assured the minister that he could count upon the department's fullest co-operation in connection with the industrial and agricultural planning contemplated by him.

With a vote of thanks by Sri. K. Unnikrishna Menon, the resident vice president of the Union, to the Director and to the several ladies and gentlemen who contributed to the success of the various functions, the Conference concluded.

The Students and officers of the Agricultural College entertained the Hon. Minister and other visitors on the 13th night. Short pieces in English, Telugu, and Tamil were enacted.

The College Day sports were held on Saturday, the 15th inst. and the Union was 'at home' to a large gathering of visitors. Mrs. D. D. Warren wife of the District Collector, kindly gave away the prizes.

As usual an exhibition featuring the activities of the department was held for the benefit of the public. This attracted a large crowd of visitors from the agricultural classes and educational institutions.

The Annual conference of Departmental officers was held on the 14th and 16th July under the chairmanship of the Director of Agriculture at which several topics pertaining to the administration of the department were discussed.

With the annual general body meeting of the Union held on the 16th morning the College Day and Conference came to a successful termination.

Welcome Address.

By R. C. Broadfoot Esq., President of the M. A. S. Union.

The Committee of the Madras Agricultural Students' Union, the organizers of this annual function, extend a very cordial welcome to all present at this, the twenty-eighth Annual College Day and Conference and express the hope that the Conference will be like its predecessors, of benefit to those privileged to take part in its proceedings.

To you, sir, I would express on behalf of the Union our grateful thanks for accepting our invitation to preside over this conference. As Minister in charge of Industries and Labour, you have opportunities to co-ordinate the work of your Department with those of Agriculture and lasting benefit is likely to accrue to our rural areas through such co-ordination.

We welcome Sri P. H. Rama Reddi, our Director of Agriculture, and we express satisfaction at the honour recently conferred on Rao Bahadur V. Ramanathan, Cotton Specialist and Rao Bahadur K. Gopalakrishna Raju, Provincial Marketing Officer. The former as our editor and vice-president and the latter as one of our moffussil vice-presidents, have always taken a keen interest in the Union and its work. We greatly regret the premature retirement of Messrs. D. G. Munro and A. C. Edmonds who retired from service during the last year.

From the Conference programme you will note that a departmental exhibition has been arranged in the Freeman Building. The object of this exhibition is to bring forward in a convenient and concise manner the work of the research sections at the Agricultural College and Research Institute. The exhibition will be open daily till Saturday and I hope all will find time to pay it a visit during their stay.

The Central Farm like the adjoining areas of Coimbatore District has suffered greatly from drought and great difficulty has been experienced in maintaining a reduced area of cereal and fodder crops. As a result there are fewer representative crops than usual at this date, but the Farm yard, Dairy, Veterinary Hospital and Botanical Gardens are worthy of a visit from those interested in the practical side of our work.

We hold our Annual Sports on Saturday when the Union will be at home to all members and friends. We will welcome a large attendance at this function.

Last year saw another change in our educational policy, resulting in a redistribution of teaching responsibility whereby Chemistry, Botany, and Zoology classes become the responsibility of the respective research officers. A new post, that of Senior Lecturer in Agriculture and Superintendent, Central Farm, has been created and the designation of Assistant lecturers changed to Teaching assistants. Tradition in an educational institution is of similar importance to good-will in business. Changes interfere with its growth and are to be deprecated. It is too early to evaluate the effect of the change, but the college still maintains its popularity as a training centre, there being a substantial increase in the number of applications for admission this year. The new students have been selected with due regard to language, community and district.

The results of last year's B. Sc. (Ag.) examinations were very satisfactory and as a result, 40 agricultural graduates have been added to the number

qualified for a degree and desiring an opportunity to show that their training has a practical value in rural reconstruction.

Medals and prizes won during the last session will be presented during this Conference and I congratulate the winners on their success. Prize winners must realise that while the prize goes to a particular student the margin of marks is often very close and less fortunate students may derive comfort from this thought. To all students who have left this College, I wish the best of luck and fortune and I hope all will have some chance of playing their part in the future development of this great rural country. None is better qualified.

Finally a word on your duty towards the Union. It is hoped that wherever you may be you will continue your allegiance towards the Madras Agricultural Students' Union and help to maintain it as an important link between your work and your college days. It is worthy of and will appreciate your support in the years to come. In addition to its other functions the Union acts as an Employment Bureau. Unemployed graduates are advised to keep in close touch with the Secretary for such advice and assistance as is available.

Now to the Union's welcome I add my personal thanks for your presence and assistance in making this Conference a success.

Messages.

The following are some of the messages received :—

The Hon'ble Mr. V. I. Muniswami Pillai, Minister for Agriculture and Rural Development, Fort. St. George:

"It is a matter, of great satisfaction, that, the twenty-eighth College Day and Conference, will be celebrated, under the Presidentship, of my esteemed colleague, Hon. Mr. V. V. Giri. As one, who is greatly interested, in the development of the country, and who has spared no pains, in taking a leading part in the industrial planning, of the country, I am sure, he will put forth salient points for the true foundation of an agricultural bias among the students and, those, who are connected with the agricultural department of this province. Due to other engagements it is not possible for me to be present, witness and hear the many useful speeches, that will be made on this occasion, but I am sure, that the important points advanced by the experienced and intelligent agricultural experts, will be given due hearing by the students and others assembled on this occasion. I wish the several functions, connected with this College Day, every success.

Sir A. P. Patro., K. C. I. E., Kt.:

"Thank you very much for your kind invitation for the College Day and Conference to be held on 13th July. I regret I shall not be able to attend the functions. I have been following the activities of the Research Institute through the columns of the journal which is very interesting reading".

R. Cecil Wood Esq., Former Principal of the Coimbatore Agricultural College, Hill House, Marlesford, Woodbridge, Suffolk:

"It was a pleasant reminder of old times to receive your invitation to the twenty-eighth College Day and Conference at Coimbatore and there is nothing that would give me greater pleasure than to attend and see for myself—all the changes and improvements that have taken place since I was there.

Since your last Conference, I have retired and am now—as you will see from my address—settled in England. Please give my remembrance to those of the

Department who were my contemporaries and accept my wishes for a successful Conference."

Dr. C. R. Reddi, Vice-chancellor, Andhra University, Waltair :

"Hearty congratulations on the College Day you are celebrating and best wishes for its ever-recurring success. The College has deserved well of the Presidency by its fine work and valuable researches"

Rao Bahadur B. Viswanath, F. I. C., Director of the Imperial Agricultural Research Institute, New Delhi :

"While I am very thankful to the Managing Committee of the Union for extending a cordial invitation to the 28th College Day and Conference, I cannot help regretting my inability to be in Coimbatore in the middle of July 1939. With best wishes for the success of the function."

Rao Bahadur M. R. Ramaswami Sivan, Retired Principal :

"Owing to other engagements which I cannot put off, I have to deny myself the pleasure of attending the College Day and Conference and of participating in the Old Boys' race at the annual Sports this year. As one of the founders of the M. A. S. U. as its first general secretary and as one who has held all the offices of the Union, I have a warm corner in my heart for the Union and wish success in all the items of the celebrations, under the sympathetic guidance of my friend, the Hon'ble Mr. V. V. Giri. With Hearty greetings and good wishes."

Rao Bahadur C. Tadulingam, Retired Principal.

"I thank you sincerely for your kind invitation to the College Day and Conference commencing from tomorrow. I regret very much my inability to be present owing to pressure of work. However, I take this opportunity to wish the Conference every success under the able guidance of Hon'ble Mr. V. V. Giri."

Messages were also received from the following :—

Sir R. K. Shanmugam Chetty, Dewan of Cochin, The Pattaigar of Palayakottai, Mr. A. Kaleswara Rao, Rao Bahadur Y. Ramachandra Rao, Dr. C. N. Acharya, Mr. A. K. Menon, Superintendent, Kerala Soap Institute, The Cane Superintendent, The East India Distilleries and Sugar Factories, Rao Bahadur K Gopalakrishna Raju, Provincial Marketing Officer, Mr. Nizamuddeen Hyder, Director of Agriculture, Hydrabad, Mr. R. G. Nallakuttalam Pillai, His Holiness Kasivasi Swaminatha Thambiran Avl., Dr. Gilbert Fowler and Mr. K. Chengappa, Registrar of Co-operative Societies, Coorg.

Report of the Managing Committee of the Madras Agricultural Students' Union, Coimbatore, for the year 1938—39.

(Presented on the opening day of the Conference.)

The Managing Committee of the Madras Agricultural Students' Union have great pleasure in presenting their report for the year 1938—39 which is the twenty-eighth report of the activities of this Union.

The College Day and Conference last year, was presided over by the Hon. Minister in charge of Agriculture and Rural Development Department, and it is a happy augury that the Committee have been able to secure the presence of his

distinguished colleague, the Hon. Minister in charge of Industries and Labour Department, amidst us today. Indeed it was chiefly with a view to laying stress on the importance of a close co-ordination between Agriculture and Industry that the Committee ventured to invite the Hon. Mr V. V. Giri to preside over the deliberations of this Conference, though they were fully aware that he is one of the busiest of the Ministers in the Madras Cabinet. The Committee on behalf of the Madras Agricultural Students' Union take this opportunity to express their gratitude for the readiness with which he accepted the invitation in spite of the numerous calls on his time

The Union has watched with great interest his activities in connection with the formation of the National Planning Committee, and is gratified to note that in the programme of that body, the development of scientific agriculture occupies a foremost place. Insurmountable as the obstacles seem to be today, owing to various disintegrating forces, the Union firmly believes that the salvation of our country lies in the concentration of our entire national will and energy on a co-ordinated plan of agricultural improvement and industrial expansion.

In this connection, may we, as men closely associated with agriculture, mention that notwithstanding the doubts expressed in some quarters, partly due to ignorance of world conditions, but mostly due to an inherent dislike that is in most of us to innovations, it is possible to raise the general level of crop production in India as elsewhere by intelligent application of modern science in our agricultural practices.

Russia, Germany, United States of America, Italy, England, indeed, all the civilised countries of the world, have within the last two decades, made their lands yield much more than the maximum yield during the beginning of the century.

The wise conservation ot natural resources, the increase in the production of nitrogenous and other fertilisers, the widening of man's knowledge with regard to the activities of the millions of associated organisms which play an important role in increasing or decreasing crop production ; the opening up for agriculture of new areas which, forty years ago, no human endeavour could have made to grow a single blade of grass, and the tremendous advances made in the science of plant breeding, have all contributed in increasing the output of the world's agricultural produce to an extent undreamt of before. And add to this, the extremely efficient organisation of marketing that obtains in most of these countries, has raised the standard of life of the farmer far above that met with in India.

What has been possible elsewhere is also possible in India. The achievements of the Agricultural Department in the Madras Presidency have not been insignificant, though considerable work still lies ahead, such as (1) conservation of manure and utilisation of waste products, (2) prevention of soil erosion, (3) improvement of livestock, (4) more extended supply of water to the villages, (5) maintenance of irrigation tanks and extension of irrigation projects, (6) extension of electricity to rural areas, (7) fruit preservation and (8) improved facilities for marketing. We may, in this connection, be permitted to submit that in the long run, it may not be a wise policy to restrict the activity of this Department or curb the enthusiasm of its members because of either financial stringency or the absence of immediate and perceptible monetary return for the amount spent on it.

The Government have shown their solicitude for the welfare of the ryot by various beneficial measures, such as the Prohibition Act, Debt Relief Act, the

Public Health Act, suspension and remission of revenues in various districts. the hastening up of the Tungabhadra project, schemes for rural water supply, etc, and we have no doubt whatever, that ere long they will direct their attention towards a well defined plan of agricultural improvement. In this connection we have to mention the regrettable fact that a good number of young men who have passed out of this college are without employment. Various proposals have been made from time to time, with regard to these men. We shall not attempt here to discuss the merits or demerits of all these proposals, but we would respectfully suggest that as matters stand at present, it will be in the best interests of Government to employ these men for the benefit of the rural classes. The graduates of this institution are, by their training, eminently suited for carrying out all branches of work connected with the villages and it is the earnest request of the Union that their talents and energy be recognised and utilized to the best advantage. We are glad that the Co-operative Department has advertised for enlisting a few of these men in its service, but we have to note with a tinge of regret that the salary offered may not attract our best men.

So far as the sphere of activities with which we are intimately connected is concerned, we would like to point out that the Department still suffers for want of more hands to carry on its work. The disquieting rumours of retrenchment have to a certain extent disheartened the members of the Union. We would earnestly request, that before any scheme of retrenchment is carried out, due care is taken that important limbs of the Department are not axed and we hope that more liberal amounts will be spent on this Department. In this connection, we cannot but express our sense of regret that our sister Institution, the Forest College had to be abolished at a time when proposals for national reconstruction are receiving the attention of some of India's best brains. Next to Agriculture, forests are the most important assets to the wealth of this Presidency, and we hope, as has been happily expressed recently by His Excellency, the Governor, that the possibility of revival at some future time, should facilities and resources become available, will not be forgotten.

College Day and Conference, 1938. The celebration of the College Day and Conference, one of the main activities of the Union, took place last year from the 21st to 23rd July under the distinguished presidency of the Hon'ble Mr. V. I. Muniswami Pillai, Minister in charge of Agriculture and Rural Development. The Conference attracted many visitors, including Mr. N. S. Varadachariar, Parliamentary Secretary. Thirteen papers comprising a wide range of agricultural subjects were read at the Conference by departmental officers and non-official workers.

On the 21st night, the students of the College entertained the Minister and other visitors by staging dramas and farces. The annual Athletic Sports were held on the 23rd July, and Mrs. P. H. Rama Reddy kindly gave away the prizes.

As usual, an Agricultural Exhibition depicting the various activities of the Department was held for the benefit of the visitors and the public.

A welcome feature of the Conference was a pleasant trip to the P. S. G. & Sons' Charity Industrial Institute, Peelamedu, kindly arranged by the management.

The Madras Agricultural Journal:— We are glad to state that during the year under report the Journal was published with promptness and regularity. The Journal continued to maintain the high standard associated with it. It is with pardonable pride that we mention that the Journal is becoming more and more popular and maintaining its high standard of excellence, not only among the research workers in the different departments and institutions, but also among

the puplic who are interested in improving agriculture. This Journal has on its exchange list a wide range of publications, including those from many foreign countries. In view of the great services now rendered by the Journal to the cause of improved agriculture, may we request you sir and through you the sympathetic and popular Government, to kindly consider the grant of a subsidy to the Union in order to enable it to be of more service to the country. We would also like to make use of this opportunity to appeal to the landed aristocracy of this country to extend their sympathy to the Union and the cause it serves by becoming patrons and thereby strengthening the financial resources of the Union.

Our Members :—We are glad that during the year, Sri. V. Ramanatha Ayyar, Cotton Specialist, and Sri. K. Gopalakrishna Raju, Provincial Marketing officer, have been honoured with the title of 'Rao Bahadur". We offer our hearty congratulations to them, both members of the Union, on the well merited distinction conferred on them. It gives us pleasure to record that Dr. J. S. Patel M. Sc. (Cornell), Ph. D. (Edin), the Oil seeds Specialist and our ex-editor, was appointed as the Jute Specialist under the Indian Central Jute Committee, Calcutta. We are glad that Dr S. Ramanujam, B A. (Hons), Ph.D. (London), Assistant to the Paddy Specialist was appointed as the Second Economic Botanist at the Imperial Agricultural Research Institute, Delhi, and that Sri. P. Uthaman, B.Sc Ag, M. Sc, Assistant to the Paddy Specialist, accepted the post of first Research Assistant in Paddy breeding under the Government of Orissa. We are glad to note that Rao Bahadur T. S. Venkataraman, C. I. E, Sugarcane Expert and Mr. K. Ramiah, M. B. E., officiating Director, Institute of Plant Industry, Indore are invited to attend the ensuing Seventh International Congress of Genetics to be held in Edinburgh towards the end of August. The election of Rao Bahadur G. N. Rangaswami Ayyangar, F. N. I., I. A. S., as Member of the Council of the National Institute of Science of India, Calcutta, for the year 1939 and the appointment of Mr. K. Cherian Jacob, Assistant in Botany, as member of the Fodder and Grazing Committee are matters of great satisfaction to us.

Obituary :— We record with regret the passing away of Mr. M. E. Couchman, C. I. E., I. C. S., who was the first Director of Agriculture of our Province from 1906 to 1911. It may be recalled with pleasure that the first Agricultural Conference was held under his distinguished presidentship in the year 1911, the year of founding of the Union.

We have also to record with regret that Rao Bahadur D. Balakrishnamurthi, Retired Deputy Director of Agriculture, Sri. A. V. Thirumuruganatham Pillai, Retired Assistant Director of Agriculture, and Sri Arogiyaswami Pillai, Retired Assistant Curator, passed away during the year. The cruel hand of death has also snatched away from amidst us three of our promising young friends while they were still in harness, viz., Messrs. P. Gopalarathnam, Assistant, Cotton Section, K. Vasudeva Shenoi, Agricultural Demonstrator, Coondapur and Rajagopal Mal, Agricultural Demonstrator, Nanguneri.

Acknowledgment:— It is now our pleasant duty to record our thanks to all who helped the Union during the year. To the Hon'ble Mr. V. I. Muniswami Pillai, who presided over and guided the deliberations of the Conference last year the Union owes a deep debt of gratitude. To the gentlemen who contributed papers for the Conference we tender our sincere thanks; to Mrs. P. H. Rama Reddi who kindly distributed the prizes for the Sports, we record our grateful thanks; to Mr. P. H. Rama Reddi, The Director of Agriculture, the Committee tender their heart-felt thanks for his keen interest in the Union and the

invaluable help rendered by him in arranging the Conference last year; to Mr. R. C. Broadfoot, who as president was actively helping the Union in its various activities our grateful thanks are due.

Our thanks are also due to all the other ladies and gentlemen who in various capacities helped the Union in the celebration of the College Day and Conference last year.

Presidential Address.

BY THE HON'BLE MR. V. V. GIRI

Ladies & Gentlemen,

I am deeply grateful to the Madras Agricultural Students' Union for the honour conferred on me in being invited to preside over this conference. It is indeed a pleasure, to associate myself with the activities of your department, which is in charge of my distinguished colleague the Hon. Mr. V. I. Muniswami Pillai, who is not only a minister but also an expert agriculturist himself. I can lay no claim to such distinction myself. You are lucky, in having a minister like him, and I am sure, you can expect a great deal from him. Before coming to this conference, I had occasion to go through the back numbers of your Journal, the perusal of which gave me an idea of what the Madras Agricultural Students' Union is doing, and I am glad to find, that the Union has been conducting its deliberations, all these years, in an excellent manner; and the Journal published by them is indeed very useful and deserves encouragement. I shall, certainly convey your desire for a subsidy to the minister concerned (Cheers).

It is needless for me in this place, to emphasise the importance of the agricultural industry in India. India is preeminently an agricultural country. It may be, that agriculture is not a paying proposition today but on that account, we cannot give up what is our primary industry. Nor can we give up our hand-loom weaving industry which, next to Agriculture, is the biggest industry of the province. Mills may come and mills may rule, but agriculture and hand-loom weaving are bound to persist—and shall persist. I consider it therefore, the bounden duty of everyone of us including the Government, to seek ways and means to make agriculture pay. It is an irony of fate that when agriculture is the primary industry of this country, a few students trained in this college are not all able to find a place in life, after they have finished their scholastic career. To my mind, the reason seems to be that the young men study in the College, with the sole object of securing a place under the Government. This is not, as it should be. I would ask the young graduates of the College to think more in terms of service to the people than look merely for service under Government, for after all, Government could give jobs to only a few people. If only the students of this college after completion of their course went to the landowners and undertook to organise their agricultural industry, I have no doubt that many landlords would agree to put their lands under the care of these young men. What is needed, is a change in the outlook of the students themselves.

The next point to consider is, how to make agriculture a paying proposition. Improved methods of farming have to be introduced, but the methods must be such as are evolutionary and not revolutionary in their character—methods which suit the genius of our race. There should be persistent organisation, and in this, the young students of this college have a great part to play. They should make the villager understand that the use of certain modern implements will be beneficial to him. My own feeling in the matter is, that no young man should be allowed to take his degree, though he has passed the examination, before he got into the rural parts, studied rural economy,- say for a period of six months, and produced some publication. We must have a net work of these villages having young men whom I would call as village guides, who will know something about co-operation, about agriculture, sanitation; in short about everything pertaining to rural parts. The aim of these men should be to make the village a happy place to live in.

I turn now to another aspect of the problem. It is not enough, if those who are interested in the prosperity of the country concentrated their attention on big industries and key industries alone. They should also think in terms of agriculture combined with cottage industries. Unless we create a subsidiary occupation for every family in the village, we cannot make agriculture pay.

Indian agriculture is suffering from another serious handicap—the lack of facilities for proper marketing and publicity of the goods produced through cottage industries. If cottage industries in Japan or elsewhere have succeeded, it is because of the proper marketing of the goods produced. It is to facilitate proper marketing of the products of the cottage industries that the Government are encouraging the establishment of museums, in every district, to begin with. If this scheme is successful, very soon we shall attach emporiums to the museums, so that people wanting particular articles could, on seeing them in the museums, get them then and there at the emporiums. If people wanted these articles in dozens and hundreds of dozens, we are conceiving the idea of opening ware-houses, for these articles. That is the programme of the Government and it is by the willing cooperation of everybody that this movement could be made successful. I am sure the students of the Agricultural College have a great role to play in this work.

Co-operation has a great part to play in rural prosperity. Co-operative societies must look after every aspect of human life in the village. Co-operative societies should also have, hereafter, multi-purpose ideas. I desire that the by-products of agriculture and industries that are possible through agriculture in rural areas, should be developed to the fullest extent, through co-operative societies. In this connection I am glad to find that research is done in this institute towards making India self-contained in malt. India imports from elsewhere Rs. 84 lakhs' worth of malt and most probably the raw material was sent outside for the purpose. I do not see why we should

not be self-contained with regard to this product, and save Rs. 84 lakhs to the producer of raw material in this country. Not only malt-making, but many other things are possible in this country.

Regarding the problem of the unemployed, let me assure you that the Government have been giving deep consideration to this question and have also gathered statistics. Here again, I have to state that the unemployed are equally responsible for the present state of affairs. I am almost tempted to think that most of our unemployed are unemployable also. If they are asked to go to the villege and do work, they will only think in terms of clerical jobs. No doubt it must be made possible for young men to stay in the village. But there must be the persistent desire in them to make any proposition successful.

Reference has been made to the National Planning Committee in the report of the Union. I am glad to note that the Madras Agricultural Students' Union appreciates the efforts of that committee in regard to the co-ordination of agriculture and industry. The committee has decided to set up 29 sub-committees to deal with agriculture and industries, and it is indeed a matter of gratification that the whole country is co-operating in this great enterprise. Not only all the provinces of India, but also the Indian states are lending their whole-hearted support to this committee.

Before I conclude, let me appeal to those young men who pass through this institution, to be the harbingers of a new era of prosperity and wealth to our country. You must be the agents to produce harmony between landlords and the ryots in the village. A time may come when you may have to tackle these things, and you will be doing a great service to the country, if you cease to be mere book-worms but like tried practical men, maintain peace in Industry and Agriculture. (Cheers and prolonged applause).

List of Winners of Prizes for the Year 1938—39.

1.	The Robertson prize.	A. Sankaram.
2.	The Clogstoun prize.	K. S. Mahalingam.
3.	The Keess prize.	V. Venkatasubramaniam.
4.	The Sampson memorial prize.	N. Satyanarayana Reddy.
5.	The Dewan Bahadur R. Raghunatha Rao prize.	R. V. Alagiriswami & A. Sankaram
6.	The D'Silva memorial prize.	K. Bhaskaran.
7.	The Goschen prize.	K. Bhaskaran.
8.	The Anstead prize.	M. D. Azariah.
9.	The Rao Bahadur K. S. Venkatarama Ayyar prize.	K. M. Somanna.
10.	The L. D. Swamikannu memorial prize.	N. Satyanarayana Reddy.
11.	The Certificate Course cup.	K. Bhaskaran.
12.	The Old Cuddapah District Agricultural Association prize.	N. Bhaskara Reddy, T. D. Muthuswami & N. Satyanarayana Reddy.
13.	The Gupta prize.	B. Narayana Reddi.
14.	The M. K. Nambiar prize.	K. Bhaskaran.

Papers.

The following were the papers presented;—

1. **Fruit introduction: its problems and place in the national wealth—** ***M. Bapineedu.***
2. **Sugar industry in Madras—*R. V. Sundara Reddy.***
3. **Cambodia Cotton -*A. Kannayya.***
4. **Some ploughing experiments—*V. Ramanatha Ayyar, S. Sundaram & N. C. Tirumalachari.***
5. **Rice crop in Tanjore Delta—*M. Anandan.***
6. **Cultivation of rice and the best method of marketing—*M. Gopala Chetty.***
7. **Self help in economic farming—*K. Unnikrishna Menon.***
8. **The present position of the pollu disease of pepper in Malabar—*K. M. Thomas & K. Krishna Menon.***
9. **Rock-bee honey, its extraction and prescrvation—*M. C. Cherian & S. Ramachandran.***
10. **Soil and water losses by run-off—*A. Subba Rao, S. V. Kuppuswami & A. Abdul Samad.***
11. **The main cause of crop failure in the black soil tract of the Bellary district—*C. Vijayaraghavan & V. Panduranga Rao.***
12. **Cashewnuts—*C. T. Ittyachan.***
13. **Need for research in irrigation—*S. Krishnamurthi,***
14. **Plantain in Madras and its orderly marketing—*Louis J. Royal.***
15. **Cotton improvement in Tinnies and the necessity for its concentration—*K. L. Ramakrishna Rao.***

President's Concluding Remarks.

Ladies and Gentlemen,

Let me congratulate the Union on the successful culmination of a most interesting session of their Conference. We have listened with profit to a number of instructive papers, though I regret that all the papers presented at the Conference could not be read for want of time. I am told, however that all these papers will, in due course, be published in your journal, and reach the wider public for whom they are intended. The discussion that followed some of the papers brought forth from two young men, views which were thought provoking—almost thought irritating. I appreciate them greatly. Mr. Louis had said that he is in a position to give us suggestions if the Government are prepared to co-operate and act on them. I most gladly accept the offer, and I would turn round and say to Mr. Louis "give us your suggestions first, and then see whether the Government co-operates or not". I do not say this in any spirit of derision. The way in which Mr. Louis had put in his views would provoke even a Government to do something and certainly it is the duty of Government to do something.

In this connection I am glad that Mr. T. V. Rajagopalachariar has put forward a very sound proposition for the Government to think over, and we have the assurance of the Director of Agriculture that he would give his attention to the subject. I have no doubt whatever that the minister in charge of Agriculture would do his best in the matter. Mr. Kannayya, wants to know what the intentions of the Government are in regard to this matter and what they are going to do about it. Let me assure him that the Government

are earnestly trying to find ways and means to put into effect some of their proposals such as, agricultural colonisation on a co-operative basis or otherwise wherein educated young men would be given an opportunity to show their mettle, their industry, and see how far they could provide for themselves and make a living. This proposition has been gone into very carefully by Government and I hope the decision would be soon known. I regret, however, to state, in this connection, that the experience of some of those who believed in this colonisation scheme, is far from encouraging. It is not to throw any cold water on the enthusiasm of any person that I am making this statement, but solely in order that the pros and cons of the question may be clearly and dispassionately discussed and the enthusiasts as well as the critics of the scheme may think for themselves and put forward practical and concrete suggestions. Those who have been working on these colonisation schemes seem to feel after some time that the matter is not so simple as was imagined. They found that young men who came to these colonies retained their enthusiasm for a few days only, in spite of the fact that they were provided with food and shelter. If ten came not even two remained, at the end of the first few months Some of them left the place without even giving notice. This is a sorry state of affairs but I am a confirmed optimist in life, and am never discouraged -- no, not even by this experience. I am a firm believer in the colonisation scheme myself and shall endeavour to give it a fair trial.

Young men should be brought to these colonies and made not only to work like ordinary agricultural labourers but also be given help in the shape of subsidiary industries so that they may be in a position to make a living for themselves. This subject had attracted my attention long before I became a Minister. Every effort shall be made in this direction; and the suggestions given by Mr. T. V. Rajagopalachariar and Mr. V. C. Vellingiri Gounder will be gone into not in a spirit of lip sympathy but with the definite practical sympathy on the side of the Government to see how far this idea could be exploited to the fullest advantage of the unemployed. A Government was not worth its name unless it tackled this problem and gave ordinary happiness and contentment to its subjects It was up to the young men also to co-operate in an honest, sincere, persistent and consistent manner to see how this ideal could be achieved in practice. You should not think that simply because ten men happened to become ministers you could put all the weight on their shoulders and expect everything cut and dry and prepared. You are also part and parcel of this Government. You have a right to direct the Government as to how this ideal could be put into effect. If there is co-operation on all sides, the Government, the public and the unemployed, I am certain even this great demon of unemployment can be exorcised without much difficulty in a country like ours with its vast and varied resources.

Mr. Kannayya was referring to the question of agricultural demonstrators and want of patronage. I am sure a demonstrator would work not only

as a demonstrator but also as a social servant of the country who was bound to do social service out of his free will and not merely because he was paid. It all depended upon the spirit with which one worked. Therein lay the success of any undertaking. I am sure the time would soon come when the demonstrator will cease to be a demonstrator visiting a place only once in four months. It may not be possible to give a demonstrator to each village. But the time is coming when there should be expert demonstrators whose number was double and treble of what they are now. But still there must be some persons like a jack of all trades who know something about everything; about the demonstrator's work, about the co-operator's work, about radio, etc. so that they can be useful to the villager. I can assure you the Government are also thinking in these terms as to how to provide such a machinery to help the rural population consistently throughout the year. This Government will not stop with investigations or merely set up some committees or commissions which were generally connected with omissions, but theirs would be commissions which would put their ideas into effect.

Before I conclude I must really congratulate the Director of Agriculture and the authorities of this college for training the students and themselves in a way that when they expressed themselves even the ordinary people were able to understand what they were talking about. I have learned a great deal about agriculture, in fact, more than I had learned during the 45 years of my existence and I really feel that I should make it a point as often as time would permit to attend conferences of this character. I am not saying so in any spirit of convention but I feel conscientiously that it will do good not only for myself but all the ministers to attend such conferences not as Ministers but as students willing to learn. **This institution deserves the support of the Government in every possible way.** I must confess that I had no idea of the work that is going on here. I am very glad to have known the inside of things to some extent, regarding the administration of this department and the way in which these annual conferences are being conducted. They are really beneficial and I do also feel that a conference of this sort should not be ended in two days but should have several days' discussions. The Government have a duty of establishing agriculture on an efficient basis with a network of cottage industries attached to it throughout the length and breadth of the country. I can assure you that this Government is not only responsible but responsive. Therefore it is bound to take into account the suggestions made from every quarter so long as those suggestions were useful and beneficial to the country.

Thank you very much for your patient hearing. (Cheers).

College Day Athletic Sports.

The Annual sports were held on Saturday the 15th July on the spacious and artistically decorated grounds of the College. The weather conditions on the three days preceding the sports were threatening; the slight but persistent showers, though they greatly alleviated the dust trouble, gave indication of making

their unwelcome presence felt on the sports day as well. But thanks to the last moment much-desired change in the weather conditions, the sky cleared and left us in peace to proceed with sports in almost ideal conditions.

There was a fairly keen competition among the contestents, in all the events. The record in Javelin throw was improved by Sri. R Veeraraghavan by 9 feet and 7½ inches on his own throw last year. The record in High jump, 5 feet 1 inch was also equalled This achievement also goes to the credit of R. Veeraraghavan.

M. R. Mohan Punja scored an aggregate of 55 out of a possible maximum of 120 marks by winning the first place in 5 events—Long Jump, 220 Yards Dash, Shot put, Quarter mile and Half mile and second place in High jump and thus secured the much coveted distinction of being the champion for the year. The next highest points, 36. were obtained by R. Veeraraghavan.

Mr. R. C. Broadfoot, President of the Union, made a short speech before requesting Mrs. D. D. Warren to give away the prizes. Sri. H. Shiva Rau, the President of the sports committee, proposed a hearty vote of thanks to Mrs. Warren for readily accepting the invitation and distributing the awards.

The Union was 'At Home' to all the Ladies and gentlemen who responded to, the invitation. The Union's thanks are due to Mr. & Mrs. M. C. Cherian, Mr & Mrs. M. Kanti Raj and other members of the Tea sub-committee for their assistance in arranging and receiving the guests for the 'At Home'

The successful conduct of the Sports was largely due to the untiring efforts of Sri H. Shiva Rao and other members of the Sports Sub-committee.

List of Prize Winners.

Cross Country Race (5 miles). (The Norris Cup). 1. D. Sundar Raj. 2. D. N. Murthy. 3. K. Narayana Rao.

Hundred Yards. (The Saidapet Old Boys' Cup). 1. L. V. Ratnam. 2. R. M. Sastry. 3 D. N. Murthy.

Long Jump. 1. M. R. M. Punja. 2. D. N. Murthy. 3. M Ch. Kaulutlayya.

220 Yards. 1. M. R. M. Punja. 2. H. N. Kamath. 3 D. N. Murthy.

Shot Put. 1. M. R M. Punja. 2 K. M. Somanna. 3. R. V. Raghavan.

High Jump. (Rao Bahadur C. Tadulingam Cup). 1. R. V. Raghavan. 2. M. R. M. Punja.

Quarter Mile. (The Prince of Wales Cup) 1. M. R. M. Punja. 2. H. N. Kamath. 3. N. Sreshta.

Cricket Ball Throw 1. R V Raghavan. 2. H N. Kamath. 3. S. V. Srinivasan.

Half Mile. 1. M. R. M. Punja. 2. H. N. Kamath. 3. N. Sreshta.

Javelin Throw. 1. R. V. Raghavan. 2 H. N. Kamath 3 K. M. Somanna.

Half Mile (Invitation). 1 and 2 Government College Secondary and Training School.

120 Yards Hurdles. (Rama Swami Sivan Cup). 1. D. N. Murthy. 2. H. Madhuram. 3. R. V. Raghavan.

Old Boys' Race (Handicap). 1. A. Mariekulandai. 2. K. K. R. Menon.

One Mile. (The Anstead Cup) 1. H. N. Kamath. 2. N. Sreshta. 3. R. M. Sastri.

Inter Tutorial Relay Race. (The Chunampet Shield). Mr. K. M. Thomas' wards.

Obstacle Race. 1. R. M. Sastry. 2. D. N. Murthy. 3. M. R. M. Punja.

Intertutorial Tug of War. (Ramnad Shield). Mr. K. M. Thomas' wards.

Champion—M. R. M. Punja.

Soil and Water Losses by Run-off.

By A. SUBBA RAO, D. Sc., F. Inst. P.,
S. V. KUPPUSWAMI, B.A.
& A. ABDUL SAMAD, B.A., B. Sc. (Ag.),
Dry Farming Station, Bellary.

Erosion is a problem which is receiving increasing attention today. The enormous losses of soil which take place in a slopy or undulating country are well known. In the tract represented by the Hagari Dry Farming Station conditions are favourable for heavy losses of soil and water by surface run-off. The soil is clayey (black cotton soil), slow in allowing percolation of rain water to lower layers and the land is undulating in nature Though the annual rainfall is 21 inches, about half of this is received within the course of about six weeks between September and October. The two main *Hingari* crops of the area, cotton and sorghum have to depend on the rainfall received before or about the sowing time, as the rainfall during the crop period is practically negligible. The land is not capable of absorbing the rainwater as fast as it is received. All these factors viz., the heavy nature of the soil, the undulating nature of the land and the great intensity of the rainfall contribute to severe erosion. Thus sheet erosion is a constant feature after heavy rains. Control of erosion and conservation of moisture are the most important problems of the tract.

An attempt was made during the last two years to determine the amount of water and soil lost by surface run-off in plots specially constructed for the purpose—two plots 66′ × 3¼′ (Area 1·25 cents) with a gradient of 1 in 80 (Plate 1) were selected. On three sides each plot was enclosed by galvanised iron sheets and the run-off was collected into masonry cisterns towards which the plots slope. The amount of water and silt collected as run-off was measured after each rain. Samples of run-off waters were analysed for total salts, lime, and nitrogen. These were also determined in samples of rain water collected on the corresponding days and the values obtained for the run-off waters corrected. The silt collected in 1937-38 was analysed for physical and chemical composition. During 1937-38 both the plots received the same treatment to start with viz., hand hoeing by the blade harrow and the results for the first season served as duplicates.

The data obtained for 1937-38 is summarised below: Out of a rainfall of 9·2 inches received on 11 days between the 3rd September & 13th October 1937, 4 inches of rain have been lost as run-off carrying with it 6·6 tons of silt per acre. The amounts of total salts, lime and nitrogen washed off per acre are 100·6, 2·45 and 0·11 pounds respectively. The rainfall lost is 44 per cent of the rainfall received on days when there was run-off.

Effect of throwing the land into pockets:- During 1938-39 in one of the run-off plots scoops were formed before the rainy season in order

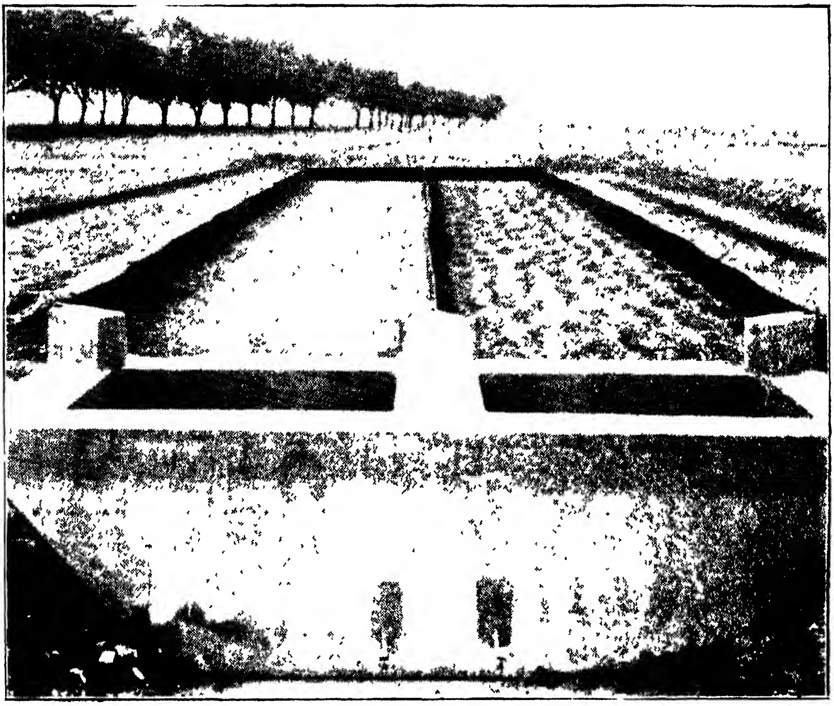

Plate 1. Run-off Plots.

to study their effect on the control of run-off. The usefulness of throwing the land into pockets is clear from the following figures for the run-off obtained for 1938-39.

	Control plot.	*Scooped plot.*
Number of days when there was run-off (between the 3rd July 1938 and 30th September 1938.) ...	**13**	**10**
Total rainfall on days when there was run-off in either of the plots	**15·66″**	**15 65″**
Silt washed in tons per acre	**9·86**	**3·60**
Rainwater lost in inches	**7·52**	**3·29**

In the control plot about 50 per cent of the total rain water was lost as surface run-off which is in agreement with the results of the previous season. A single storm on the 28th-29th September 1938 was responsible for nearly a third of the total loss of silt and one-fourth of the total loss of water by surface run-off in the control plot. The pockets into which one of the run-off plots was thrown, effectively decreased the run-off of water to less than half the value for the control plot, while the silt washed off was nearly a third of the value for the control plot.

Physical analysis of the silt washed off the land showed that it consisted of about 80 per cent of the fine fractions clay and silt and chemically it was richer than the original soil. The nitrogen content of the silt was 0·043 per cent while that of the soil was only 0·024 per cent. Similarly, the 'loss on ignition' was higher for the silt than for the soil. The silt washed off from the surface is, therefore, richer than the soil both from the physical and chemical point of view. During the course of the washes, the coarser particles settle down and the finer richer material is washed off.

It is interesting to note in this connection that at the Sholapur Dry Farming Station (1) it was found under the same conditions of gradient and size of plot that in a clean fallow plot, 5·8 inches of rain water and 25 tons of soil per acre were lost during 1935-36 when the rainfall on days when there was run-off amounted to 14·8 inches. The soil removed per inch of rainwater lost was 4·3 tons per acre, while the corresponding figures for Hagari are 1·6 tons per acre during 1937 and 1·3 tons per acre during 1938.

Some of the American workers have reported considerable losses of soil by erosion. In Texas Agricultural Experiment Station Reports (2) it was reported that "with every inch of water lost, there was approximately 3 tons per acre of soil by erosion."

As pointed out earlier in the paper, the actual amount of silt or water washed off depends on the intensity of rainfall and the physical condition of the soil apart from the slope of the land. But it is clear that in places where the problem exists, it is very serious and all attempts should be directed towards controlling the run-off.

During 1936-37, in one short spell of heavy rains it was found that land differently treated absorbed rainwater as follows in the layer 0 to 3 feet

Rainfall between 23—9—'36 and 10—10—'36 = 6'79'
=687 tons of water
per acre.

Treatment.		Percentage of rainfall absorbed by the soil.
Control (no bunding, no ploughing)	...	10·1
Bunded only	...	28·6
Ploughed and bunded ...	...	40·6

(The losses include moisture lost by evaporation and run-off).

When the intensity of rainfall is very high, only 10 per cent. of the rain water was absorbed by the 'Control' field while 'bunding' and 'bunding combined with ploughing' helped to retain 29 and 41 per cent. respectively of the rainfall received during the period.

Indirect Influence of Conservation of Water. (a) Conservation of moisture has another indirect effect on these heavy soils. It is well known that clayey soils crack heavily due to the swelling when wet and shrinkage on drying. The changes in the volume of the soil are very large and it was found that the soil at Hagari is capable of a total shrinkage of over 65 per cent. by volume when passed through a sieve of 100 mesh to the inch i. e., when 165 cubic feet of soil are dried completely starting from the 'sticky point' (about 40% moisture content) the volume will be reduced to about 100 cubic feet. In the field the shrinkage will be naturally less than this owing to the presence of coarse particles and as the range of moisture, the soil has to pass through, in one season is limited. If, however, we can succeed in reducing the desiccation of the soil during crop growth, the shrinkage will be less and there is less possibility of wide cracks developing during the crop period.

(b) A second and more interesting effect of conserving moisture in heavy soils arises out of the following considerations. Heavy soils on account of their high colloidal status tend to become sticky when wet and very hard when dry. Losses of soil moisture by evaporation are most effective in the top 12 inches of the soil. This layer after reaching the maximum field capacity for moisture during the rainy period is subjected to sudden drying thereafter. The layer of soil between 3 inches and 12 inches thus becomes very hard if the desiccation is rapid—the top three inches of soil remaining in a loose and friable condition, being disturbed by interculturing and exposed to alternate heating and cooling on account of diurnal fluctuations of temperature. If this hardness sets in later in the life of the plant, when it has established itself well, it may not affect the crop growth; but if, by adverse weather conditions, the hardness sets in early, the crop suffers very badly on this account. By conserving moisture, the setting in of the hard layer may be postponed to a stage when it is of no consequence to the growth of the plant.

References.

1. **Report of the Bombay Dry Farming Research Scheme, Sholapur and Bijapur for the year 1935—36. Page 14.**
2. **Texas Agricultural Experiment Station Reports 1927 and 1928.**

Rice Crop in Tanjore Delta.

BY M. ANANDAN, L. Ag.,
Superintendent, Agricultural Research Station, Aduturai.

Origin of the Tanjore Delta Thousands of years ago, the area occupied by this fertile delta must have been a deep inland sea extending upto Tirukattupalli, the westernmost point in it. The view that this delta must have been a deep sea is also strengthened by the fact that borings taken down to 300 feet on the Aduthurai Agricultural Station brought up only deposits of clay and sand, and failed to strike any rocky stratum throughout this depth. It must have been naturally formed by the slow deposit of alluvium brought down by the Cauvery river and its branches. If we assume that the river Cauvery spreads silt over this million acres to a depth of $\frac{1}{8}$th of an inch annually, it would have taken nearly a century to raise the level of the land by a foot. The quantity of silt so deposited each year would be about 12 million tons. Taking the present average altitude of the delta at 75 feet above the sea level, the land mass should have emerged out of the sea more than 7500 years ago. So the colonisation of this delta must have occured within the last 7500 years if the rate of annual deposit of silt has been $\frac{1}{8}$th of an inch as assumed. We may also assume that the colonists were acquainted with the rice plant and they must have brought it with them for growing in this new area.

Area under rice. Out of the 11 million acres under rice in this Presidency, Tanjore delta alone accounts for a million acres. This area is being steadily increased by bringing under paddy cultivation land commanded by the Grand Anicut Canal commonly known as the Mettur Project area or the new Delta, though in the strict sense of the word it is not a Delta at all. An addition of $2\frac{1}{3}$ lakhs of acres is expected to be developed in this area.

Soil of the delta. The soil, as already stated, is of alluvial origin and is mostly clayey in texture and deep. It shrinks during the summer and as a result cracks heavily, the cracks extending to 2 feet in depth and 2 to 3 inches across. The western half of the delta has soils of coarser texture than the eastern half. The soil is very peculiar in its behaviour. It is very sticky when flooded and waxy when handled in the course of drying after a flooding. It is friable after a heavy rain in summer, particularly so after deep cracking, and produces excellent tilth when ploughed. But ploughing the land during summer is considered harmful by the cultivators and so the bulk of the land is left unploughed and remains a bare fallow till inundated during the next paddy season in June. Experiments conducted on the Aduthurai Station for five consecutive seasons have confirmed this belief to be true as ploughing invariably reduced the yield of the succeeding rice crop by about 10 per cent. Soils are generally deficient in nitrogen, phosphoric acid and humus.

Paddy season. Before the construction of the Mettur dam, the paddy season in this delta used to start during the last week of June or as late as the 10th of July depending on the arrival of the freshes in the Cauvery which in turn depended upon the early or late outbreak of the South West monsoon in Coorg. But after the advent of the Mettur irrigation system, water is allowed for starting the cultivation precisely on the 15th of June each year. This has advanced the paddy season in this delta by 3 weeks and gives certainty of water supply to enable the *mirasdars* to raise their nurseries in time and prepare in advance their cropping scheme for the season with greater exactitude. The paddy season closes by the end of February of the following year.

Climate and rainfall. The annual range in temperature is between 60° and 112° F. The cool months of the year are from October to March with temperature ranging from 60° to 98° F., while the hot summer months are from April to September with temperature ranging from 70° to 112° F., the hottest month usually being May.

The average annual rainfall is about 43 inches, the hot weather months from March to May account for about 5 inches; the South West monsoon from June to September brings in 8 inches and the North East monsoon from October to January makes up the balance of 30 inches.

Number of paddy crops taken during the year. More than a fourth of the paddy area is cropped twice during the season, the first crop known as *Kuruvai* occupying the land from June to the end of September and the second crop known as *Thaladi* from October to the end of February. The rest of the area which forms the bulk is cropped only once during the year. It is cropped with *Samba* which runs from the middle of July to the middle of February of the following year.

The varieties grown during the *Kuruvai* or the first crop season are of short duration, ranging in age from 90 to 120 days, while those grown as the second crop and the *Samba* crop are of long duration, ranging from 5 to 7 months.

Another system of growing paddy peculiar to this district is the deliberate mixing of seeds of a short duration *Kuruvai* of 90 days with a 7 months samba variety called *Ottadan* in the proportion of 3:1. The seedlings raised from such mixed seeds are planted in bunches in the field. The result is that the plants coming from *Kuruvai* seeds come to harvest at the end of the third month while the cut stubbles of the young *Ottadan* crop start their vigorous growth after the harvest of the *Kuruvai* crop and comes to harvest only at the end of the seventh month. This system of growing two paddy crops with a single operation of sowing and of planting is known locally as *Udu* cropping. It is practised in about a lakh of acres chiefly in areas incapable of draining during the rainy season.

The practical consideration that has guided the grower in taking a short duration crop first and a long duration one as second crop is mainly based on the outbreak and duration of the North East monsoon rains. He plants

and takes off a short duration crop from June to September before the onset of the North East monsoon in October. He plants the long duration samba and second crops before or during the North East monsoon rains and brings them to harvest after the rains have ceased in January. This plan works generally well because in both cases he tries to secure the crops in bright weather, the first crop before, and the samba and second crops after the North East monsoon rains.

Sowing and Planting. There is hardly any broadcast paddy crop in the Tanjore delta. The universal practice is to raise the seedlings in nurseries and transplant them. For *Kuruvai* crop, nurseries are raised under semi-dry conditions while for *Samba* and *Thaladi* crops they are typically wet. To plant an acre the *mirasdars* use 10 cents of land as nursery. So to plant the million acres under rice, they use a lakh of acres for nurseries each year. This is as it should be But, unfortunately, they sow 2½ to 3 Madras measures of seed in each cent of such nursery where there is room and necessity only for 1 Madras measure to produce robust seedlings to plant an acre. Instead of sowing 100 lakhs of Madras measures of seed in one lakh of acres of nursery, they are unnecessarily overseeding them and wasting away year after year 150 to 200 lakhs of Madras measures of seed out of pure ignorance. The direct loss in value of seed so thrown away which they can totally avoid, is anything from 12 to 15 lakhs of rupees each year, taking the price of seed at 12 Madras measures per rupee. This practice has been going on for centuries. I am afraid the rice growers in other parts of the presidency also waste seed similarly. I am sure that the paddy seed so wasted is worth nearly a crore of rupees per year in this presidency. The indirect loss in yield of crops by planting ill-developed and puny seedlings resulting from the thickly sown and overcrowded nurseries is still more colossal. Putting 2 *kalams* or 48 M.M. per acre as the average reduction in yield by this practice, the loss from a million acres will be 2 million *kalams* of paddy every year worth 3 million rupees taking the price of paddy at Rs. 1—8—0 per *kalam* of 24 M. M. If this wastage could be stopped through some means and the savings so effected are spent on manuring the rice crop, the country would be infinitely richer than what it is to-day.

Pulling and transport of seedlings are solely done by men but the actual planting is done by women. An acre takes about 10 to 12 women to plant. Seedlings are planted in bunches of 4 to 10 spaced 8 to 10 inches apart.

Cultivation and Manuring. Transplanted fields get a *mammatty* digging followed by a course of 3 or 4 ploughings with the country plough, the depth of ploughing or digging never going beyond 4 inches below the surface. It is indeed a difficult task to make the *mirasdars* use iron ploughs and other more efficient implements so long as they neglect to maintain far better work-animals than they now possess.

Kuruvai crop gets the bulk of the poorly prepared cattle manure and ashes, while *Samba* crop gets little of them. Green manure, mostly *kolinji*

and to a small extent *daincha*, is grown in about a lakh of acres now. *Mirasdars* are showing great interest in extending the area under green manures, specially *daincha*, after seeing the good yields obtained at the Aduthurai Research Station as a result of the combination of green manures and artificials. An increase of 50% in yield of the rice crop in Tanjore is a practical and highly paying proposition if the *mirasdars* can be induced to adopt the following manurial programme the Aduthurai Research Station has been adopting and advising during the past six years. Plough in 4,000 lbs. of green manure, apply 25 lbs. of bonemeal and 25 lbs. of superphosphate at the time of planting and 50 lbs. of ammonium sulphate per acre 50 days after planting a *Samba* crop or 25 days after planting a *Kuruvai* crop, costing in all about Rs. 6 per acre. This manurial programme would involve growing *daincha* crop in about $2\frac{1}{2}$ lakhs of acres and buying 11,000 tons of bonemeal, 11,000 tons of superphosphate and 22,000 tons of ammonium sulphate for manuring the million acres. This may cost 6 million rupees annually.

This programme, if persistently followed, will result in an extra yield of 15 million *kalams* of paddy or about 19 million rupees taking the present average yield as 30 *kalams* per acre, and the selling price of a *kalam* at Rs. 1—4—0. The net annual increase in wealth after deducting the cost of manuring will then be about 13 million rupees for this delta.

Irrigation and drainage. The main irrigation channels take off directly from the Cauvery river and its numerous branches traversing the delta. These main channels are connected with a network of branch and field channels. They serve as drainage channels as well. Due to long neglect by the cultivators they have silted up badly and so have gone down in efficiency considerably, especially so as a drainage system during the rainy season when the flat delta gets inundated. In irrigating their rice crop, *mirasdars* wrongly believe that they should maintain an ever increasing depth of water in their fields in keeping with the growth of the crop Experiments conducted on the Aduthurai station have definitely shown that for getting the maximum yields there is no necessity to keep more than 2 to $2\frac{1}{2}$ inches of water in the field at any time and that no harm results if no standing water is allowed in the fields for 2 days in between the two waterings. This question of intermittent irrigation has a great bearing on the question of mosquito breeding in the paddy fields, apart from the question of the economic use of the irrigation water from the Mettur system which has cost the tax-payer nearly 7 crores of rupees.

Harvesting and Threshing. Harvesting of the crop is done both by men and women, 8 men and 4 women forming a team to finish the harvest, transport, threshing and winnowing the produce of an acre. Transporting is generally done by men while women help in passing sheaves to the men engaged in threshing and winnowing the threshed produce. No machinery of any kind is used for harvesting, transporting, threshing, winnowing, bagging or storing the produce from the million acres of rice in the delta

except the simple sickle, the bamboo winnow, the improvised mud threshing floor in the fields on elevated grounds, the unfailing seasonal winds during the afternoons and the human labour. The estimated annual production of paddy (or rice in the husk) is 30 million *kalams* of 24 Madras measures each. Out of this quantity, one million *kalams* are reserved for seed and the remaining quantity is available for local consumption and export.

Aduthurai Agricultural Research Station & its usefulness. The station is located almost in the centre of the delta and has been and is still playing a useful part in the improvement of the rice crop since its inception 17 years ago. It has been possible to evolve high yielding strains either through selection from existing varieties or through hybridisation of desirable types. The Station has issued for general cultivation 17 strains during the 17 years of its existence. Half a dozen more strains are almost ready for release shortly. At a most conservative estimate, these strains have covered more than 7 lakhs of acres in this delta and an equal area in several other districts of this presidency

The increased yields given by these strains over the unselected varieties grown by the cultivators vary anything from 10 to 30%. Even taking the lower figure as the average increase, for assessing the extra yield obtained by the growers, it represents an increase of 3 *kalams* for every acre grown with the strains, or 21 lakhs of *kalams* from the 7 lakhs of acres in this delta alone or in money value over 30 lakhs of rupees. The growers in other districts of the presidency are also getting similar benefits, judging from the increasing demands from those districts for several of the paddy strains of the station. The other directions in which the Aduthurai station has helped the rice grower are in the use of the improved ploughs, more efficient and labour saving implements like the green manure trampler, the puddler and the levelling boards, the method of preparing ideal seed beds, the growing of green manure crops like *daincha*, sunnhemp and *pillipesera* during different seasons of the year and the correct combination of artificials with green manures so grown, to get the maximum yields. The station yields obtained in this season which is acclaimed to be very adverse speaks eloquently of what is possible if improved methods of cultivation are followed. The average of the *Kuruvai* crop was 3,600 lbs. per acre, the maximum being 3,900 lbs. and of the *Samba* crop well over 4,000 lbs. with a maximum of 4,950 lbs. and of second crop 2,300 lbs. with a maximum yield of 2,600 lbs., while the average yields obtained by the mirasdars for respective crops were only 2,300 lbs., 1,900 lbs. and 1,500 lbs.

The yields obtained on the Aduthurai station show in every case an increase ranging from 50 to 100% over those obtained by the *mirasdars*. They also show clearly that by adopting scientific methods in growing the rice crop, much of the rigour of an adverse season can be neutralised.

So I make a fervent appeal to the rice growers of the Tanjore district, in particular, and to those in other districts, in general, to adopt the improved methods that have been found to give an increase in yield, and profit by them.

The Madras Agricultural Students' Union.

The Annual General Body meeting of the Madras Agricultural Students' Union was held on Sunday, the 16th July 1939 with Mr. R. C. Broadfoot, Principal of the Agricultural College and *ex-Officio* President of the Union in the chair. Sixty members including 17 students were present The President in his introductory remarks thanked the various sub-committees of the Conference for the successful way in which the College Day was conducted this year. He made particular mention of Mrs. M. C. Cherian and Mrs. M. Kanti Raj who were responsible for the excellent arrangements made for the 'At Home', on the Sports day. He also complimented the Secretary for his work during the year.

The minutes of the previous meeting were then read and adopted.

The annual report, including the statement of accounts for the year 1938—39, was then presented before the meeting. Mr. M. R. Balakrishnan in proposing the adoption of the annual report congratulated the Managing committee on the successful way in which the affairs of the Union were managed. He appealed to the moffusil members to enlist more members to the Union and more subscribers to the Journal. The report was then adopted *nem con.*

The next item in the agenda—the consideration of the Budget, prepared by the Managing Committee, evoked a good deal of discussion, consequent on Mr. S. Krishnamurthi's suggestion that a sum of Rs. 100 be set apart for tea exclusively for members, moffusil and local, in order to enable them to meet together. After a lengthy discussion, it was proposed that the expenditure for such a 'social' be restricted to Rs. 50 per annum. This proposition was put to vote and carried. Rao Bahadur V. Ramanatha Ayyar moved that the budget with the above modification be passed. This was seconded by Sri P. S. Narayanaswami and then passed by the General Body.

The resolutions, given notice of by the Managing Committee, (vide members' supplement) were moved from the chair and passed by the house unanimously.

The following office bearers for 1939—40 were then elected:— **Council** Moffusil Vice president:— Messrs. K. C. Naik, U. Vittal Rao and M. Anandan; Moffusil members:-- Messrs. D. Panakal Rao, M. R. Balakrishnan, N. H. V. Krishnamurthy and K H. Subramaniam; Resident members:— Rao Bahadur S. Sundararaman, Rao Sahib P. V. Rajagopalachariar and Rao Sahib V. Muthuswami Ayyar. **Managing Committee.** Resident Vice president:— Mr. M. C. Cherian; Editor:— Mr. K. M. Thomas, Secretary:— Mr. K. Sanjiva Shetty; Manager.-- Mr. S. Krishnamurthi; Treasurer:—Mr. V. Gomathinayagam Pillai Members:— Messrs. S. M. Kalyanarama Ayyar, M. A. Sankara Ayyar, and P. A. Venkateswara Ayyar. **Editorial Board.** Editor, Secretary, Manager, and Messrs C. M. John, M. S. Kylasam and C. S. Krishnaswami.

The election of a student representative, in addition to the ex-officio club Secretary, for the above bodies, was held over to be conducted at a meeting of the student members.

A resolution of condolence moved by Mr. K. Unnikrishna Menon on the sad demise of Rao Bahadur D. Balakrishnamurthi, Messrs. Thirumuruganatham Pillai, M. Arogiaswami Pillai, R. G. Mal Vasudeva Shenoi and Gopalaratnam, was unanimously passed, all members standing.

In winding up the proceedings Mr. K. Unnikrishna Menon thanked Mr. R. C. Broadfoot, the President, for his guidance and help in managing the affairs of the Union. He also expressed his thanks to Mr. M. C. Cherian who took his place

and discharged the duties of the Vice-president, in his absence. He also mentioned the sad fact that many officers of the Department were not members of the Union.

Report of the Managing Committee for the year 1938—'39.

The Managing Committee beg to present the following report of the activities of the Union for the year 1938—39.

Membership:-- The strength of the Union as it stood on 31st May 1939 was 450 against 460 last year and 450 of the previous year. We have again to record with regret that many officers of the Department—over two-fifths—are not members of the Union. We take this opportunity to appeal to such of those District Officers who are not already members to enlist themselves and also help us in enlisting more members to the Union so that the financial position of the Union may be on a sounder basis. Although last year the membership of the students was 113, it came down to 94 this year. We hope that this temporary decline will be made up this year, through the efforts of Mr. M. Kantiraj, the hostel warden.

Office-bearers:-- Consequent on the transfer of Dr. J. S Patel, the Editor, to Dacca as Jute Specialist as well as the resignation of Mr. Bhavani Sankar Rao, the Manager, two vacancies arose in the Managing Committee; the former vacancy was filled up by Mr. M. C. Cherian and the latter by Mr. V. Gomathinayagam Pillai. In the temporary absence of the Resident vice-president, Mr. K. Unnikrishna Menon, the Managing Committee requested and authorised Mr. M. C. Cherian to look after the duties of the Vice-President which he kindly accepted to do.

General Body Meeting:— A general body meeting of the resident non-student members was held on 1—10—1938 with Mr. R. C. Broadfoot in the chair in order to consider the representations made by students at the time of the last general body meeting. The resolutions passed at that meeting were circulated to members in the form of a supplement to the *Madras Agricultural Journal* for October 1938.

Meetings of the Managing Committee:— Eight meetings of the Committee were held during the year.

Journal:— The Journal continued to be published with promptness and regularity during the year. The Committee wish to record that a fairly good number of articles on various subjects was received for publication in the Journal. We take this opportunity to record our thanks to the various authors who have contributed to the success of the Journal. But we wish to mention with regret that, in spite of requests, contributions of general agricultural interest from officers who are working in the districts were comparatively few. We take this opportunity to appeal to these officers to evince more interest in the Journal and in the public by sending popular articles and thereby helping the cause of improved agriculture.

Editorial Board:— In the vacancy caused by the elevation of Mr. M. C. Cherian to the editorial chair, Mr. M. S. Kylasam was elected as a member of the Editorial Board. We have great pleasure in recording our thanks to Dr. J. S. Patel who was the Editor of the Journal till November 1938 as well as to Mr. M. C. Cherian who succeeded him and to other members of the Editorial Board for the efficient conduct of the Journal.

Subscribers:— The number of subscribers (non-members) to the Journal during the year was 230 as against 180 of last year and 200 of the previous year. Thirtyfive journals (Indian and foreign) were in the exchange list. The incre se in the number of subscribers is an indication of the popularity of our Journal. The moffusil members would be rendering a great service to the Union if they would help in enlisting more subscribers and making the Journal more popular.

Finance. The auditors' report and the financial statements are now presented before you. Our finances have maintained fair progress in spite of the fact that during last year the receipts under donations and entertainments for the College Day were far below our expectation, being only about a half of the budgeted amount.

Employment of Agricultural Graduates. We regret that the Union has not been of more service in the matter of finding employment for Agricultural Graduates. We hope that the Director of Agriculture would be good enough to look into this matter and redress their grievances.

Ramasastrulu Endowment. We received two papers for this prize but we regret to report that the judges were of opinion that the papers were not of a sufficient standard to merit the prize.

Lectures. Under the auspices of the Madras Agricultural Students' Union Rao Bahadur B. Viswanath delivered a lecture on "New Pusa" on 1—8—1938 and Dr. Pattabhi Sitaramayya addressed the members of the Union on 17—6—1939 both under the presidency of Mr. R. C. Broadfoot, the President of the Union.

Acknowledgment. Now it is our pleasant duty to thank the various members of the Union who helped it during the year. We have pleasure in recording our grateful thanks to the conveners and members of the various sub-committees who wholeheartedly helped us in celebrating the College Day last year. We are specially grateful to Mr. & Mrs. Cherian Jacob who arranged the Tea for the visitors on the Sports Day and to Mr. C. Ramaswami who was responsible for conducting the Sports successfully. Our thanks are due to Mr. J. H. Longrigg, Principal, Madras Forest College, for loaning us tents and chairs. We need not add how indebted the Union is to Mr. R. C. Broadfoot, Principal and President of the Union who has been as kind and sympathetic as ever and ready to help and guide us in managing the affairs of the Union.

P. A. Venkateswaran,
Secretary
For the Managing Committee.

Crop and Trade Reports.

Groundnut - 1939 — Summer and early crops — Condition report. Sowings of the summer crop of groundnut and of the early crop in the districts of Salem and Coimbatore are generally below normal on account of insufficient water supply as a result of the failure of the North-east monsoon last year.

Harvest of the summer crop of groundnut has commenced in parts. The yield is expected to be normal only in South Arcot and below normal in the other districts. The early crop of groundnut in Coimbatore is generally fair.

The wholesale price of groundnut (shelled) per imperial maund of 82⅖ lb. (equivalent to 3,200 tolas) as reported from important market centres on 10th July 1939 was Rs. 5—0—0 in Cuddalore, Rs. 4—12—0 in Vizagapatam, Rs. 4—9—0 in Guntur, Rs. 4—8—0 in Vizianagaram, Rs. 4—3—0 in Cuddapah and Vellore, Rs. 4—2—0 in Tadpatri, Rs. 3—15—0 in Nandyal, Rs. 3—14—0 in Adoni and Bellary, Rs. 3—13—0 in Hindupur and Rs. 3—12—0 in Anantapur. When compared with the prices published in the last report, i. e., those which prevailed on 11th April 1939, these prices reveal a rise of about 27 per cent. in Tadpatri, 24 per cent. in Adoni and Cuddapah, 22 per cent. in Bellary and Hindupur, 21 per cent. in Vizagapatam and Nandyal, 20 per cent. in Vizianagaram and Vellore, 19 per cent. in Cuddalore and 18 per cent. in Guntur and a fall of about 5 per cent. in Anantapur

(*From the Director of Industries and Commerce*).

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 14th July 1939 amounted to 340,060 bales of 400 lb. lint as against an estimate of 388,900 bales of the total crop of 1938–39. The receipts in the corresponding period of the previous year were 310,721 bales. 259,711 bales mainly of pressed cotton were received at spinning mills and 122,721 bales were exported by sea while 111,879 bales were imported by sea mainly from Karachi, Bombay and Egypt.

(From the Director of Agriculture, Madras).

College News and Notes.

Students' Corner — Students' Club. The inaugural address of this club was delivered on the 14th July by Sri Bapineedu, Parliamentary Secretary to the Hon'ble Minister for Public Information with Hon'ble Mr V. V. Giri Minister for Industries and Labour, in the Chair. The learned lecturer exhorted the students to be ambitious in life and to play their great part in the building of our nation. The president endorsed the advice given by Sri Bapineedu.

Cricket. The opening match of the cricket season was played on Sunday the 16th inst. between the old boys and the rest. Messrs C. Ramaswamy and H. Shiva Rao opened the innings for the ' rest '. Their side declared after scoring 127 for 7 wickets (C. Ramaswami 22, K. M. Somanna 39, Satyanathan 35) The old boys followed and were all out for 174 (K. K. Menon 35, Varadarajan 50, Mukundan 49, S. V. Srinivasan 5 for 45). The old boys thus won the match.

Personal. We are glad to learn that two of our members, Mr. K. Ramiah, Geneticist and Botanist, Institute of Plant Industry, Indore and Rao Bahadur T. S. Venkataraman, Sugarcane Expert, have been invited to attend the International Congress of Genetics at Edinburgh.

We note with pleasure that the Government of India have been pleased to extend the term of service of Rao Bahadur T. S Venkataraman, Govt. of India Sugarcane Expert, for a period of three years.

University Board of Studies in Agriculture. A meeting of the Board was held in Madras on 8th July. Messrs. R. C. Broadfoot, G. N. Rangaswami Ayyangar, C. Ramaswami, H. Shiva Rao and M. C. Cherian attended from Coimbatore.

The Association of the Upper Subordinates. The Annual General Body Meeting of the above Association was held on 14th July 1939 After the reading and adoption of the Annual report for 1938–39, the following Office bearers for 1939--40 were elected.

President : - Sri S. Dharmalinga Mudaliar
Secretary :— Sri P. A Venkateswaran

Members of the Working Committee :
Sri S. M. Kalyanaraman
„ C. Rajasekara Mudaliar and
„ P. K. Natesa Aiyar.
Auditor : „ M. S. Kylasam.
The meeting then terminated with the annual tea.

Visitors. The Director of Agriculture, Madras was camping here from the 12th to the 16th in connection with the College Day and Conference. Sri Samiappa Mudaliar, M. L. C. visited the Agricultural College & Research Institute on the 22nd.

Weather Review—JUNE 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	4·9	−0·9	6·1
	Calingapatam	3·6	−1·1	5·7
	Vizagapatam	1·9	−3·0	4·8
	Anakapalli*	1·9	−2·7	4·0
	Samalkota*			
	Maruteru*	1·2	−2·6	2·6
	Cocanada	3·9	−0·9	6·7
	Masulipatam	4·1	−0·4	4·6
	Guntur*	2·3	−1·2	3·2
Ceded Dists.	Kurnool	2·1	−0·9	2·7
	Nandyal*	2·0	0·0	0·0
	Hagari*	2·0	−0·3	2·6
	Siruguppa*	1·2	−1·9	1·5
	Bellary	0·9	−1·0	3·1
	Anantapur	3·3	+1·3	5·9
	Rentachintala	2·9	...	3·4
	Cuddapah	2·3	−0·6	4·1
	Anantharajupet*	2·1	+0·6	7·8
Carnatic	Nellore	0·3	−1·0	4·3
	Madras	1·1	−0·8	7·2
	Palur*	0·5	−1·3	13·0
	Tindivanam*	2·6	+0·4	9·4
	Cuddalore	0·2	−1·3	16·2
Central	Vellore	1·6	−0·8	10·1
	Salem	4·2	+1·2	15·2
	Coimbatore	0·2	−1·5	4·9
	Coimbatore A. C. & R. I.*	0·1	−1·4	4·4
	Trichinopoly	3·7	+2·3	14·5

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	0·3	−1·0	18·0
	Aduthurai*	0·1	−1·4	16·4
	Madura	2·7	+1·3	14·8
	Pamban	0·0	−0·1	8·3
	Koilpatti*	0·0	0·0	0·0
	Palamkottah	0·0	−0·6	5·0
West Coast	Trivandrum	12·1	−1·3	28·1
	Cochin	41·1	+12·6	63·2
	Calicut	33·6	−0·9	43·7
	Pattambi*	22·1	−1·8	33·1
	Taliparamba*	32·8	−3·9	38·8
	Kasargode*	41·0	+2·6	44·9
	Nileshwar*	29·7	−11·2	32·9
	Mangalore	37·2	+0·4	42·2
Mysore and Coorg	Chitaldrug	3·7	+0·9	8·5
	Bangalore	3·3	+0·5	12·4
	Mysore	1·6	−1·3	10·6
	Mercara	12·9	−9·9	15·8
Hills	Kodaikanal	3·2	−1·0	20·0
	Coonoor			
	Ootacamund*	4·9	+0·6	15·3
	Nanjanad*	4·9	−2·7	11·3

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette.

Both the Bay of Bengal and the Arabian sea branches of the monsoon were active from the 2nd week of the month, causing general rain in Malabar, Konkan, and North Hyderabad and local rain in Mysore and the Bombay Deccan and a few falls in the Madras Deccan and North Madras Coast. The rainfall however was in defect throughout the Presidency.

Skies were moderately to heavily clouded in the western half of the Peninsula while it was lightly to moderately clouded elsewhere. Humidity was in excess in Malabar, Konkan and North Deccan while it was in defect in the North Madras Coast, South East Madras and the Madras Deccan.

Day temperature was above normal in North Madras coast, parts of South East Madras, Mysore and the Madras Deccan. Rentichintala recorded 115°F on the 3rd.

Heavy rainfall.

Calicut 4·6″ on the 7th.
Mangalore 8·1″ on the 16th.
Cochin 3·9″ on the 16th.
Pattambi 3·0″.
Nileshwar 3·4″.

Weather Report for Agricultural College and Research Institute Observatory.

Report No. 6/39.

Absolute maximum in shade	98·5°F
Absolute minimum in shade	70·0°F
Mean maximum in shade	90·5°F
Departure from normal	+1·5°F
Mean minimum in shade	73·6°F
Departure from normal	+0·5°F
Total rainfall for the month	0·08″
Departure from normal	−1·40″
Heaviest fall in 24 hours	0·06″
Number of rainy days	Nil.
Mean daily wind velocity	7 m. p. h.
Departure from normal	−0 4 m. p. h.
Mean humidity at 8 hours	64 8%
Departure from normal	−4·7%

Summary. A south westerly wind characteristic of the monsoon set in on the 6th and continued to be active throughout the month. The monsoon however was not active. The rainfall was only 0·08″ which was far below normal. The maximum and minimum temperatures were above normal while the mean humidity was below normal. P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notification.

1. Appointment.

Sri. S. N. Chandrasekhara Ayyar, Assistant in Botany, is appointed to Category 8 of Class I, Madras Agricultural Service to officiate as Lecturer in Botany with effect from the date of taking charge *Vice* Sri. P. S. Jivanna Rao, granted leave.

2. Leave.

Name of officers.	Period of leave.
Sri. P. S. Jivanna Rao, Lecturer in Botany Agri. College, Coimbatore.	L. a. p. for 2 months and 13 days from the date of relief.

Subordinate Services.

1. Posting.

Name of officers.	Posting.
Sri R. Sunderarajan.	A. D. Tanjore.
,, K. Krishnan,	A. D. Fourth Circle.
,, R. Guruswami Naidu.	A. D. Kaikalur.
,, N. V. Krishnamachari.	First Circle.
,, N. Sobhanadhri.	Asstt. in Cotton,, A. R. S. Guntur.
,, I. L. Narasimhalu.	Lab. Asst. Mycology, Coimbatore.
,, N. Muthuswami.	Lab. Asst. Entomology, Coimbatore.

2. Transfers.

Name of officers.	From	To
Sri H. Govindaramayya,	A. D. (on leave)	F. M., A. R. S. Pattukottai
,, T G Muthuswami Ayyar.	F. M A. R. S. Pattukottai,	F. M. A. R. S. Palur.
,, K. V. Seshagiri Rao,	Asst A. D. (on leave),	A. D Hindupur.
,, S V. Parthasarathy	Offg. Asst. in Cotton, A. R. S Koilpatti,	Offg. Asst. A. R. S. Guntur.
,, S. Sundaram.	Asst. in Cotton,	A. R. S, Koilpatti.
,, D Hanumantha Rao,	A. D. Kothapetta,	A. D Kaikalur.
,, N. Srinivasa Rao,	A. D. Hospet,	A. D Kavali.
,, K. Ramanujachari	A. D. Kavali.	A. D Nandyal
,, V. Chidamparam Pillai	F. M (on leave)	A. D. Sankarankoil.
,, K. Gourangamurthy,	Offg. F M. A. R. S. Samalkotta,	Offg F. M, A. R. S Maruteru.
,, K. L Ramakrishna Rao,	Offg. Asst. in Cotton A. R. S. Koilpatti,	II. Circle,
Janab A. Azimuddin Sahib,	Offg. Live Stock Section.	A D (under training) Trichinopolly.
Sri K. V. Natesa Ayyar,	A. D. Ponneri,	S. A. G. M. C. Tindivanam.
,, C. S. Krishnaswami,	F. M., A. R. S., Palur,	A. D., Chidambaram.
,, P. V. Sambasiva Rao,	A. D., Ellore,	A. D. Kothapeta.
,, K. V Reddi Naidu,	A. D., Guntur	A. D. Vinukonda.
,, M. Gopala Chetty,	A. D., Chidambaram,	A. D., Shiyali.
,, L. K. Narayana Ayyar,	A. D. Shiyali,	A. D. Tiruturaipundi.
,, P. Kesavanunni Nambiar	A. D., (on leave)	A. D., Mannantoddy.
Janab Mohamad Basheer Sahib.	Offg. Asst. in Entomology Coimbatore,	A. R. S Tindivanam.
Sri U. Narasinga Rao,	Asst. in oil seeds A R. S., Tindivanam,	Asst. in oil seeds, Coimbatore.
,, A. K. Annaswami Ayyar,	F. M, L. R. S. Hosur,	A D. Sivaganga.
,, M. C. Krishnaswami Sarma,	A. D. Sivaganga,	A. D, Sattur.
,, P. A Kunhiraman Nambiar,	A D., Sattur,	A. D., Dindigul.
,, M Somayya,	F. M., A. R. S., Nandyal,	A. D., Kandukur,
,, T. Krishna Reddi,	A. D. Koilkuntla,	A. R. S., Nandyal.
,, S Muthuswami,	A. D., Tiruttani,	A. D., Gudur.
,, K. Varadachary,	A. D., Chingleput,	A. D., Saidapet.
,, S. Kuppuswami Ayyangar,	A. D, Saidapet,	A. D., Trivellore,
,, S. V. Parthasarathy,	A. D, Trivellore,	A. D, Chingleput.
,, A. Gulam Ahmed Sahib,	A. D., Saidapet (on leave)	A. D., Madurantakam.
,, P. S. Venkataswami Iyer,	A. D., Madurantakam,	A. D., Chingleput.
,, R. Venkatarama Ayyar,	A. D., (on leave)	A. D., Karur.
,, M. J. David,	A. D., Karur,	A. D. Mayavaram.
,, U. S. Aiyaswami Iyer,	A. D., Mayavaram,	A. D. Karur.
,, M. K. Swaminatha Ayyar,	A. D., Dindigul,	A. D., Papanasam.
,, M. P. Guruswami Ayyar,	A. D. Papanasam,	A. D., Tanjore,
,, T. N. Balasubramania Iyer.	A. D., Lalgudy,	A. D., Tanjore.
,, N. Ranganathachary,	A. D., Anantapur,	A. D., Dhon.
,, Y. Venkataswami,	Offg. A. D., Dhone.	A. D., Anantapur.
,, V. Kondala Rao,	Asst. A. D., Vinukonda,	A. D., Sompeta,
,, T. V. Krishnaswami Rao,	A. D., First Circle,	A. D., Vizagapatam.

Sri. Bhairy Shiva Rao,	A. D., Vizagapatam	A. D., Tuni.
,, M. Ramamurthy,	A. D Tuni,	A. D., Beddapur.
,, A. Ramohan Rao,	A. D , Peddapur,	A. D., Ellore.
,, K. Veerabhadra Rao,	A. D , Jami,	A. D., Narasipatam.
,, M Satyanarayanamurthi,	A. D., Bobbili,	A. D., Yellamanachilli.

3. Leave.

Name of officers.	Period of leave.
Sri M. L. Narayana Reddy, A. D., Palakonda	L. a p. on m. c. for 2 months from 20-7-39.
,, S. Viravarada Raju, A. D. (on leave)	Extension of l. a. p. on m. c. for 4 months from 19-7-39.
,, M. K. Padmanabhan, Asst., A. R. S., Pattambi	Extension of l. a. p. on m c. for 20 days from 15-7-39.
,, P. Lakshminarayana, Asst. A. D., Cocanada	L. a. p. on m. c. for 4 months from 4-7-39.
,, K. Krishna Menon, Asst. in Mycology, Coimbatore	L. a. p. for 15 days from 17-7-39.
,, K. Ramaswami Ayyar, A. D., Palladam	L. a. p. for 3 months from 9-6-39.
,, G. Sitaramasastri, A. D., Repalli	L. a. p. for 19 days from 3-7-39.
,, R. Govindaramayya, A. D., Musiri	L. a. p. for 1 month from 3-7-39.
,, C. S. Balasubramaniam., Asst. Entomology	Extension of l. a. p. for 1 month from 15-6-39.
,, S. G. Aiyadurai, Asst. in Oil Seeds Section, Coimbatore	L. a. p. for 16 days from 6-7-39.
,, K. M. Jacob A. D. (on leave)	Extension of l. a. p. on m. c. for 2 months
,, B. L. Narasimhamurthy Asst. in Millets, A. R. S., Anakapalle	Earned leave for 30 days from 10-7-39.
,, S. P. Fernando, Asst. A. D., Harur.	L. a. p. for 15 days from 7-7-39
,, P. R. Subramania Ayyar, A. D., Udayagiri	L a. p. on m. c. for 3 months from 7-7-39.
,, N. Annaswami Ayyar, A. D., Nandigama.	L. a. p. for 2 months from 25-6-39.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during June 1939.

A. Books.

1. *Soil Analysis: Physical and Chemical Methods (2nd Edition, Revd.).* Wright, C. H. (1939). 2. *Humus: Origin—Chemical Composition and Importance in Nature (2nd Edition, Revd).* Waksman, S. A. (1938). 3. *New Research Data on Fertilizers.* Berliner, J. J. *Pub.* (1938). 4. *Oils and Fats: Production and International Trade —Part I—Vegetable oils and fats. (Studies of Principal Agricultural Products of the World Market.)* Imperial Institute of Agriculture, Rome-Pub. (1939). 5. *Report on the Marketing of Wheat in the Madras Presidency.* Gopalakrishna Raju, K. and Chakrapani Marar. (1939). 6. *Report on the Marketing of Tobacco in India and Burma.* India Agricultural Marketing Adviser Report. (1939). 7. *A Manual for Citrus Grower.* Horn, C. W., *Ed.* (1937). 8. *Farm Economics: Management and*

Distribution. App, A. & Waller, A. G (1938). 9. *Farm Credit in Canada*. Easter Brook, W. T. (1938). 10. *Handbook for Indian Students: A Guide to the facilities for University and Professional studies and training in the United Kingdom, 8th Edition*. High Commissioner for India—London Publication. (1938).

B. Annual Reports, Proceedings etc.

1. Agriculture and Animal Husbandry in India (Annual Report) 1936-37. 2. Assam Agricultural Department Annual Report 1937-38. 3. Ceylon Agricultural Department Annual Report 1937. 4. England Empire Cotton Growing Corporation—Administration Report, 1938-39. 5. Transactions of the Highland Agricultural Society of Scotland, 1939. 6. England East Malling Research Station Annual Report, 1938. 7. Zanzibar Agricultural Department Annual Report, 1938. 8. International Crop Improvement Association—Annual Report, 1938.

C. New Periodicals.

1. "C. S. T. A. Review" (Canadian Society of Technical Agriculturists). 2. Agricultural History.

The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

Vol. XXVII.] AUGUST 1939 [No. 8.

EDITORIAL

Temple lands for agricultural improvements. During the discussions which followed Mr. Anandan's paper on Rice crop in the Tanjore delta (published in our July issue), Rao Sahib Sri T. V. Rajagopalachariar stated that several temples and mutts in South India possess extensive areas of land running to several thousands of acres which are at present leased out to villages at nominal rents. He suggested that if agricultural graduates are either employed by the temple trusts or allowed to colonise on lands leased out to them under stipulated terms, the agriculture on these lands could be re-orientated in a manner beneficial both to the temples and the lessees. Mr. Anandan endorsed Mr. Rajagopalachariar's views and suggested that one of the most profitable avenues of utilizing such lands in the delta areas by agricultural graduates would be to inaugurate seed farms for the scientific multiplication of departmental strains of paddy to meet a need which is as urgent as it is important. As matters stand at present the agricultural research stations are not able to cope with the increasing demand for improved seed, especially in the case of paddy and the supply, in our opinion, is but an infinitesimal fraction of the total demand. The utilisation of temple lands for this purpose offers great possibilities, and we are assured by the Director of Agriculture that the authorities would take up the consideration of this matter immediately on hand. In the meanwhile, we would invite correspondence on the subject from such of our readers as are in a position to offer their remarks on this scheme.

The Indian Science Congress. Elsewhere in this issue we publish a letter from the Secretary of the Agricultural section of the Indian Science Congress inviting papers from the members of the Madras Agricultural Students' Union and other workers in the field of Agricultural science, for presenting at the ensuing session of the Congress in Madras. We commend this letter to the attention of our readers.

Agricultural propaganda and the cinema. A letter from a correspondent published elsewhere in this issue, suggests the utilisation of the cinema, as an aid to propaganda, in disseminating knowledge, amongst the cultivators. The idea is not a new one and was considered by the Royal Commission on Agriculture in India as one with immense possibilities. In fact, a beginning was made in Madras as early as 1933 and one or two films were made by the Research Engineer. Apparently for financial reasons much progress has not been made and in the meanwhile, the rapid progress of the 'talkie' has left the silent film far behind.

The making of a good propaganda picture is not an esay matter. Considerable fore-thought, a fertile imagination, a high degree of technical skill

and a deep insight into the ryots' mind are necessary before a successful picture is made. The propaganda film to be effective and useful should be of such a kind, as will not only stimulate the curiosity of the onlooker, but should enable him to retain in his mind, the visual impression, received on seeing the picture. The attempt is bound to fail if handled by amateurs. What is needed is a coordinated effort of highly skilled technicians on the one hand and the Agricultural and other departments on the other. After a good picture is made, arrangements should be made to have it exhibited as widely as possible in different parts of the province. The suggestion of our correspondent to utilise itinerant cinema companies as an agency for the exhibition of the films is worth considering. We have no intention to suggest details but the system of payment of a small fee for the service would save Government the capital outlay on cine projectors and other expensive commitments.

In making propaganda pictures, excellent use may be made of the technique of animated cartoons. For example, a series of animated cartoons, may with greater force bring to the mind of the cultivator the damage caused by the devastation of an insect pest or a fungus disease than mere matter-of-fact photographs. Now that the sound film has relegated the silent film to the background suitable dialogues have to be provided for the pictures. The question of dialogue bristles with difficulties in a multi-lingual area like the Madras presidency where the pictures have to be made in atleast four languages. But these difficulties are not insurmountable and can be overcome with adequate finance and organisation. In this connection we are of opinion that the making of such films is not without commercial possibilities. The following subjects, for example, lend themselves easily to pictorial representation (1) Bee keeping, (2) poultry rearing, (3) butter making, (4) horticultural practices like pruning, budding, grafting &c., (5) care and managemet of farm animals including silage making, (6) construction of rural buildings, (7) preservation of manures, (8) rural sanitation (9) malt making, (10) spraying, dusting and seed-dressing, (11) grading, storage and transport of fruit. The list is by no means an exhaustive one, but merely shows what a wide range of subjects await the camera-man. In themselves, such films may not draw crowds to the box office, but they, would form useful adjuncts to the usual recreation pictures. According to the latest review of foreign film markets issued by the Bureau of Foreign and Domestic Commerce of the United States "in India although the possibilities of cultural development through the medium of the film have definitely begun to be recognised, educational authorities have been slow in applying themselves seriously to the subject. The question is still simmering in their minds as to the practicability of this method of instruction. A good beginning has been made in parts of the country but the field is still virtually virgin for exploitation by *foreign films*". We hope this subject will receive the attention it deserves from the provincial Governments and the Imperial Council of Agricultural Research.

Sugar Industry in Madras.

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Introduction. In this paper an attempt is made to make a study of the present position and the possibilities of expansion of the sugar industry in India, in general, and in the Madras Presidency, in particular. The scope of this study will include the different phases of the industry, right from the cultivation stage of improved strains of cane, down to the marketing side of the finished products and bye-products. This has been undertaken to bring home to the sugarcane growers and other agriculturists, owning lands fit for sugarcane cultivation, the economic advantages of adopting modernised methods of cultivation, marketing of sugarcanes, the manufacture of jaggery and refining of sugar and the further treatment of the bye-products so as to increase their utility value. The view-points of the different interests involved—the cane ryots, the factory-owners, the merchants and lastly the consumers are duly considered.

Importance of the Industry. The phenomenal headway that this industry, has made within a space of ten years, and the beneficient parts played by it, in the agricultural, industrial and social economy of the country render it a fit subject for an intensive—and careful study.

Agricultural. Sugarcane is one of the domineering crops, with its annual value estimated at sixty crores of rupees and with a cultivation area of 3½ million acres out of the total 227 million acres for the whole of India.[1] The following table will further attest the importance given to this crop by the agriculturists.

TABLE I. Growth of Sugar Industry in India since 1931—32.

Year or season.	Acreage of sugar-crop in 1000 acres.	Improved variety acerage in 1000 acres.	Average cane production tons per acre.	No. of modern factories in working.	Quantity of cane crushed Tons.	Quantity of sugar produced (cane factory production only) Tons.	Average percentage of recovery of sugar in factories.
1931—32	3077	1170	14 1	32	1,783,000	158,581	8·89
1932—33	3425	1845	14·9	57	3,350,000	290,177	8 66
1933—34	3422	2295	15·3	112	5,157,000	453,965	8·80
1934—35	3602	2433	15·1	130	6,672,000	578,115	8·66
1935—36	4154	3056	15·3	137	9,801,000	932,100	9·29
1936—37*	4440	3461	15·6	137	11.687,000	1,111.400	9·50
1937—38	3869	3600	...	136	9,916,000	930,700	9·38

* **Excluding Burma from 1936—37.**

Industrial. The Sugarcane industry is second only to the cotton industry in importance. Where India had to depend, prior to 1929, for an import of no less than 9,32,000 tons[2] costing Rs 16 crores a year, to-day,

she is in a position not only to produce her total requirements of 10,00,000 tons[3] but also she has a surplus left available for export every year. From 27 factories in 1929[4] there are, today, about 140 factories[3] working in India, with an output of about 11 lakhs of tons, the import of foreign sugar having correspondingly gone down to 13,000 tons from 932,000 tons[2]. Again, out of the total world production of 30,991,000 tons of sugar in 1937-1938, India's contribution came to 5,205,000 tons or 17·0 of the total production, thus showing that she remains, to-day, the single largest sugar producing country in the world (vide Table II.)

TABLE II. World's production and consumption of Sugar in long tons and percentage basis for the year 1937-38.

	Production.	Percentage to world production.	Consumption.	Percentage to world consumption.
Total world (Long tons Raw)	30,991,000	...	29,757,000	...
North America (United States)	1 626,000	5·2	6,100,000	20·5
Total North America	7,931,000	25·6	7,279,000	24 5
Total South America	2,034,000	6·6	1,758,000	5 9
Europe—				
Germany	2,181,000	7·0	1,825,000	5·9
France	936,000	3·0	1,093,000	3·7
Russia	2,460,000	8·0	2,176,000	7 3
United Kingdom	414,000	1·3	2,340,000	7·9
Total Europe	9,624,000	31·5	11,324,000	38·1
Asia—				
China	380,000	1·2	700,000	2·7
India	5,275,000	17·0	5,275,000	17·7
Japanese Empire	1,270,000	4·1	1,118,000	3·8
Java	1,380,000	4·5	347,000	1·2
Philippines	983,000	3 2	85,000	0·3
Total Asia	9,318,000	30·0	8,092,000	27·3
Total of Africa	1,175,000	3 8	852,000	2·9
Total of Australia	765,000	2 5	393,000	1·3
Grand Total	30,991,000	100 0	29 757,000	100·0

Social. On the social side, this industry is responsible for putting a stop to the yearly drain of 16 crores of rupees out of India ; again, it is to the credit of this industry that the vexed problem of unemployment that the Great War left as its legacy was solved in a measure, by bringing into its fold 2500 science graduates, and 100,000 un-skilled workers ; besides, the interests of no less than 20 million cultivators are linked up with this industry. Yet another—effect of this industry, the importance of which cannot be exaggerated, is the investment of no less than a sum of 30 crores of Rupees in the venture, mostly by Indian capitalists.

Protective measures of Government and the progress of the industry. In the estimation of Sir T. Vijayaraghavachariar, all these achievements are rendered possible because of the protective tariff levied on imports of foreign sugar. Thanks, to the abandonment of the *laissez faire* policy, the Government of India, passed Act No. XIII of 1932 to provide " for the fostering and development of the Sugar Industry in British India". According to this an import duty of Rs. 7½ was levied on every cwt. of white sugar imported into India, together with a sur-charge of 25 per cent. making in all Rs. 9—1—0 per cwt.

TABLE III. Comparative growth of the Sugar Industry in the various provinces since 1931—1932.

Number of cane factories working.

Provinces	1931-32.	1932-33.	1933-34.	1934-35.	1935-36.	1936-37.	1937-38.
United Province	14	33	59	65	67	68	68
Bihar	12	19	33	34	35	33	33
Punjab	1	1	5	6	4	5	3
Madras	2	2	4	8	6	11	8
Bombay	2	1	4	5	6	6	7
Bengal	...	...	2	5	6	6	6
Orissa	...	...	...	...	...	...	2
Indian States	...	...	4	5	9	8	9
Burma	1	1	1	2	2	2	2
Total for India	32	57	112	130	137	137	136

U. P. and Bihar both have about 75% of total number of factories.
Burma included up-to 1935—36.
Burma excluded from 1936—37 from the total for India.

The progress made by the Industry (Vide Tables I to III) within a short period of two years following the grant of protection was described as "almost staggering" by the under secretary of State for India. This Act was followed by the Sugar (Excise duty) Act XIV of 1934 ", another all India Act, providing "for the imposition and collection of an excise duty on sugar" manufactured under factory conditions. According to this Act, an excise duty of 10 as. per cwt. (increased to Rs. 1 from 28—2—1937) for *Khandasari* sugar (mainly produced in the United Provinces) and Re. 1—5—0 per cwt. for all other sugars except palmyra sugar, the rate for which should be fixed by the Governor-General after an enquiry was made. The latter rate of Re. 1—5—0 per cwt. stands raised to Rs. 2—0—0 per cwt. from 28—2—'37. The year 1934 saw yet another All India Act passed—Act XV of 1934 called "Sugar-cane Act 1934", to regulate the price of sugar-cane intended for use in sugar factories. Section 3 of this Act empowers Governments to declare, after previous notification in the local gazette, any specified areas as controlled areas, and, by a similar process, to fix a minimum price for the purchase, in any controlled area, of sugarcane intended for use in any factory ; by further consequential sections, penalties for contravention of notifications were provided for. But it must be noted here that those Acts were only enabling measures, permitting only such of the local governments as are desirous of taking advantage of these provisions to do so. This

perhaps, explains the position why, barring United Provinces and Bihar, other Provinces, particularly our province, do not seem to have taken full advantage of these enactments ; so far as United Province and Bihar are concerned, they have reaped the full benefits of these measures, much to the general relief of the country and the growth of the industry, vide Table IV, IV-A and IV-B.

TABLE IV. Recovery percentage obtained in various provinces.

Provinces.	In 1937-38 recovery sugar per cent.	1938-39 recovery sugar per cent.	Cane crushed tons.	Sugar made tons.
United Provinces	9·18	9.21	4,169,000	384,000
Bihar	9·58	9 15	1,858,000	170,000
Punjab and Sind	8·40	8·48	124,900	10,000
Madras	9 47	9·42	288,500	27,200
Bombay	10 97	11 13	459,600	53,400
Bengal	8·89	8·00	233,700	18,700
Orissa	8·17	8·33	18,000	1,500
Indian States	9·81	9 85	924,400	91,100

TABLE IV A. Acreage and yield of sugarcane for all provinces in India during 1936—37 and 1937—38.

Provinces States.	Area (1000 acres)		Yield (1000 tons)		Yield per acre (lb.)	
	1937-38	1936-37	1937-38	1936-37	1937-38	1936-37
United Province including T. States. ...	2181	2515	3141	3802	3226	3386
Punjab ...	512	554	363	465	1558	1880
Bihar ...	342	460	356	493	2332	2401
Bengal ...	290	355	485	626	3731	3950
Madras ...	98	122	267	339	6103	6224
Bombay including Indian States ...	116	130	284	316	5484	5445
North West Frontier Province ...	70	71	75	78	2400	2461
Assam ...	38	40	39	40	2299	2240
Central Provinces and Berar ...	33	32	50	51	3394	3570
Orissa ...	34	31	63	51	4151	3685
Delhi ...	6	5	2	6	747	2688
Sind ...	6	6	13	13	4853	4853
Hyderabad ...	30	58	60	124	4480	4789
Mysore ...	49	52	69	75	3154	3231
Bhopal (Central India) ...	7	6	6	6	1920	2240
Baroda ...	3	3	4	4	2987	2987
	3815	4440	5275	6489	52849	56030

TABLE IV B. Actual percentage of sugarcane area under various tracts to total area under cane in India in 1937--38.

U. P.	57%	Bengal	8%
Punjab	13%	Bombay	3%
Bihar	9%	Madras	2%

Yet another step calculated to help the industry, taken by the Government of India, was the announcement made by its Finance Member, in his budget speech of 1934, that a portion of the excise duty on sugar, equivalent to 1 anna per cwt. would be set aside by the Government to serve as a fund which will be distributed among the provinces where white sugar is

produced, "for the purpose of assisting the organisation and operation of co-operative societies among the cane growers, so as to help them in securing fair prices or for other purposes directed to the same end." Here again, the United Provinces and Bihar were the first to take full advantage of the grant by formulating suitable schemes to work the grant-system details about which, however, will be given in appropriate places.

Action by The Bihar and The United Province Governments. In the actual working of the various Government of India Acts, both the United Provinces and Bihar felt the need for separate comprehensive measures, and, accordingly, (The Bihar Sugar Factories Control Act 1937 Bihar Act VII of 1937) and the United Provinces Sugar Factories control Act 1938 (Act I of 1938) were passed The Bihar Act provided for (1) The licensing of sugar factories, (2) The regulation of the supply of sugarcane to factories: (3) The fixation of a minimum price for sugarcane; (4) The establishment of a sugar control board and advisory committees, and (5) The levy of a tax on the sale of sugar-cane intended for use in factories.

The United Provinces Act provided for the licensing of sugar factories and for regulating the supply of sugarcane, intended for use in such factories, and the price at which it may be purchased, and for such other matters as may be incidental thereto.

Both the Acts are to remain in force till 30th June, 1941 and both give prominence to sugar-cane growers' co-operative societies, the organisation of which was encouraged, for collectively obtaining the full benefits of planned activities. In the discharge of the executive functions, imposed by these statutes, advisory committees and sugar control boards were created.

TABLE V. Chief varieties of cane grown in the different provinces with special reference to Coimbatore. (Co) canes.

Name of Province	Name of variety	Percentage area to total cane area	Remarks
United Provinces	Co 213	60%	Dominated by
	Co 290	6%	Co canes,
	Co 240	6% 90%	
	other Co canes	18%	
Bihar	Co 213		Universal
	Co 210		Close competitor to 213
	Co 299	90%	Early cane
	Co 313		Mid season cane
	Co 331		Late cane.
The Punjab	Indigenous canes	50%	
	other canes	50%	
Bengal	Co 213	80%	
Bombay	Pundia		Universal
	E. K. 2878		Replacing Pundia
	E. K. 28		Gradually
Madras	Indigenous canes		
	Co 413		
	Co 419		Promising
	Co 421		Coimbatore canes.
Mysore	H. M 320		
	H. M. 544		Mysore canes only
	H. M. 553		Coimbatore canes
	H. M 602		not dominant.

On the non-official side, registered organisations, like the Indian Sugar Syndicate Ltd. other *ad hoc* committees and conferences and the Inter Provincial Sugar Control Board, in which both the provinces jointly participated also began to function.

Effects. The cumulative effects of the operation of these various forces resulted (1) in, the prevention of unhealthy competition, thus leading to the control of production of sugarcane, and sugar and the sale of sugar ; (2) in the elimination of wastages in cane supplies to factories, by a proper regulation of its supply, in that factories were obliged to confine their purchases within the regional areas previously declared as controlled area ; (3) in the scientific improvement of cane cultivation, with a view to increase the sucrose content of the cane and the introduction of early and late maturing varieties (vide Table I and IV).

Apart from the above benefits accruing to the immediate parties concerned, the following are some of the advantages that the country, as a whole, reaped : (1) The yearly drain of 16 crores out of the country

TABLE VI. Balance-sheets of Sugar companies and dividends since 1932.

Name of Company	Paid up capital with debentures	Net block	Dividend					
			1932	1933	1934	1935	1936	1937
	Rs.	Rs.						
Balarampur Sugar Co., Ltd.	28,00,000	29,64,640	...	...	10	10	10	3¾
Basti Sugar Mills, Ltd.	11,99,600	24,26,582	30	25	25	15	25	15
Belsund Sugar Co., Ltd.	20,49,950	18,55,000	...	...	Nil	Nil.	Nil.	Nil.
Balapur Co., Ltd.	37,59,800	16 61 000	...	...	24	24	16	14
Bharat Sugar Mills, Ltd.	7,50,000	7,17,591	...	...	...	Nil	7½	10
Buland Sugar Co., Ltd.	18,00,000	20,43,471	...	...	...	...	5	6
Carew & Co., Ltd.	20,00,000	15,84,552	12½	15	15	12½	12½	10
Cawnpore Sugar Works, Ltd.	25,00,000	36 54,357	35	30	30	25	10	5
Champaran Sugar Co , Ltd.	14,62,000	25,67,785	15	15	5	10	20	5
Deccan Sugar & Abkhari Co., Ltd	15,30,003	9,19,556	...	20	30	35	20	10
East India Distilleries & Sugar Factories Ltd.	£ 321,881	£ 282,872	10	10	7½	10	10	5
Mysore Sugar Co., Ltd.	33,01,200	31,60,814	...	...	10	11¼	15	10
New Savan Sugar & Gur Refining Co., Ltd.	11,00,000	9,71,337	15	12½	10	Nil.	10	Nil.
New Swadeshi Sugar Mills Co., Ltd	11,25,000	11,45,000	...	...	6	6	7	...
Oudh Sugar Mills Ltd.	16 48,000	19,85,000	...	...	7	6	9	...
Punjab Sugar Mills Co., Ltd.	9,74,000	9 31,864	40	40	40	15	20	15
Purnea Sugar Co., Ltd.	18 00,000	13,13 390	...	...	Nil.	Nil.	Nil.	Nil.
Purtabpore Co., Ltd.	15,00,000	18,79 819	10	10	7½	Nil	7½	Nil.
Raya Sugar Co., Ltd.	15,00,000	17,63,285	..	...	5	6	10	7½
Ryam Sugar Ltd.	7,75,000	8,35 616	30	30	15	15	10	Nil.
Somastipur Central Sugar Co., Ltd.	15 99,000	12,26,441	10	12½	Nil.	Nil	Nil	Nil.
Shree Sitaram Sugar Co , Ltd.	10,95,462	12,94,453	...	...	..	6¼	Nil	10
Sitalpur Sugar Works Ltd.	12,35,175	18,77,701	...	...	6	Nil	8	Nil.
South Bihar Sugar Mills Ltd.	11,50,000	19,73,503	...	...	10	12½	15	15
Upper Ganges Sugar Mills Ltd.	11,99,950	17,02,000	...	...	Nil	Nil.	5	7½

was prevented, thereby augmenting the income of agriculturists, labourers, unemployed science graduates etc. According to Sir T. Vijayaraghavachariar, half of the value of production went to the agriculturists as the cost

of cane and out of the balance, a good portion was paid as wages, salaries freights etc." (2) the acreage of sugar-cane cultivation was increased, much to the benefit of the ryots ; (vide Table I) (3) A fair price was ensured to the consumer despite the tariff, due to lesser cost of production. Java sugar mostly competed with the Indian production and this forced the cutting down of prices of sugar even to the extent of some of the factories working at a loss—vide Table VI. (4) the budgetary position of the Government improved, as a result of the increasing revenue the Exchequer got both in the way of import tariff and excise duty Vide Table No. VII.

TABLE VII. Yield of revenue from import duty on sugar in India.

(Burma excluded from 1936--37).

Year.	Yield of Revenue. Import Rs.	Excise Rs.
1931—32	6,19,00,000	...
1932—33	6,84 00,000	...
1933—34	4,72,04 000	...
1934—35	3,81,35,000	97,22,000
1935—36	3,24,16,000	158,84,000
1936--37	43,87,000	252 49,000
1937—38	25,33,000	33,14,800

Figures for Burma excluded in 1936--37 and 1937—38.

(5) Enterprising capitalists mostly Indian, came forward to sink more and more of their capital in the floatation of new companies, thus belying the notion that Indian capital is notoriously shy—vide Table I & VI.

Further Requirements. The progress made by this industry is undoubtedly satisfactory as far as it goes ; yet a study of the figures of production and consumption of sugar for the world, would show that there is still a greater scope to improve the industry. Table III would show that as the largest single producing country with its immense resources lying undeveloped, India can yet strive to capture the world monopoly of this industry. But alas ! owing to the inexplicable change in the policy of protection adopted by the Government of India in 1937 which found expressions in the increase of excise duty and also by the Government of India becoming a party to an International Agreement, by which India has been prohibited from exporting sugar by sea elsewhere than to Burma up to 31st December 1941, and lastly in the reduction of 0—8—0 per cwt. in the import duty, the progress of the industry got arrested all along the line. The decline is noticeable not only in the loss sustained by many of the factories but even in the drop in the output; while the optimum point, as it were, has been reached, at any rate, in the two most progressive provinces, viz. U. P. and Behar—(vide Table I). One is reminded in this connection of the observation made by that well-known economist—Professor N. S. Subba Rao, in one of his lectures on "Economic Planning"[5] delivered under the auspices of the University of Madras.

" General opinion is in favour not only of state intervention but sustained state intervention, for two reasons (to quote one of the reasons) if there is to be intervention at all, it should be continuous and not fitful or sporadic, for industry can accustom itself to continuity of influence from the state, whereas fitful intervention without anything in the nature of a plan is calculated to be both ineffective and disturbing... ...." but the world at large is apprehensive of collaboration between businessmen, and is aware that Adam Smiths' well-known gibe at them is only too amply borne out by the respective policy of cartels and international agreements between producers "

Even though the agreement, under notice here, is between governments only, yet inasmuch as they concluded it only on behalf of producers but without their consents being obtained prior to the conclusion of the agreement and in fact in the teeth of opposition its reactions are noticeable in two directions ; firstly, as already pointed out, in the all round decline of the industry and secondly in the creation of inter-provincial jealousy. In the name of a likely overproduction next year, Mr. M. P. Gandhi, the Editor of *Indian Sugar Industry Annual* 1938, put in a plea of restriction of sugarcane crop and sugar production for the coming year. This only roundly means that, as against the already established supremacy of this industry in the forward provinces, especially United Provinces and Behar other provinces working out an expansion programme have simply to cry 'halt' suddenly because, forsooth ! overproduction is feared. Fortunately or unfortunately, the Indian Syndicates forecast, as reported by 'Associated Special Service' dated Calcutta, 7—6—1939 says "the total production of sugar by cane crushing factories and *gur* refineries in India (including states) during the season 1938-1939, is 6,44,000 tons as against 9,47,000 tons during 1937-1938—a decrease of 3,03,000 tons approximately". Indeed, in the absence of any co-ordinating agency, acting in the interest of the whole of India we cannot escape such counsels.

Position of Madras. As it is, on account of a policy of inaction followed till lately by our Government, Madras occupies only the fourth rank (Vide. Table IV) in the productive strength, even though, it commands the ideal tropical climate eminently suited to push it on to the front rank. Mr. M. P Gandhi, is himself surprised at the domineering position occupied, in this respect, by the United Provinces and Bihar, inspite of their geographical position in subtropical climate. Our own surprise gets the more intense when it is considered that the crops yielding bumper yields in both these provinces are all of the Coimbatore varieties evolved in the Coimbatore Experimental Station (Vide Table V). Enjoying, then, as it does, all the favourable natural facilities for attaining a leading position and having regard too, to the wide disparity obtaining between its production and consumption figures viz. 72,000 tons of consumption of sugar as against 34,000 tons of production, Madras Presidency has not any valid excuse to take rank as a bad fourth in the matter of production. There is only one reason for this state of affairs, as it appears to us. Madras has not so far been given or what means the same thing, has not taken, all the adventitious aids, official and non-official that were taken advantage of by the United Provinces and Bihar.

Barring a belated application of the All India act in declaring certain areas, as controlled and barring again the belated formation of co-operative organisations of sugarcane growers, the effect of which cannot appreciably be measured by any reliable statistics, one feels the eleven factories of the Presidency do not seem to make the best of the situation either for themselves or for their clientele. The mere organisation of sugarcane growers' societies does not mean much to the ryots or to the industry itself in the absence of any of the separate expert bodies operating as in the case of United Provinces and Bihar.

Needs of Madras. A separate Provincial Bill, more or less on the lines of the sugar control Acts of these provinces and a periodical fixation of minimum prices for sugar-cane seem to us to be the urgent needs of the time. Details as to the basis of fixing the rate, the several other ways of developing the industry to its full reach of possibilities in this presidency, the several disabilities and limitations facing the industry in the presidency and the means of getting over them—all these would be discussed in future.

Acknowledgment. For statistics I am largely indebted to Mr. M. P. Gandhi, auther of *The Indian Sugar Industry Annual.*

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4. do. *Sugar Industry past and present* p. 92.
5 Subba Rao N. S.--Some aspects of economic planning.

The Main Cause of Crop Failure in the Black Soil Tract of the Bellary District.

BY C. VIJAYARAGHAVAN

AND

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Introduction. The black soil tract of the Bellary district, which is subject to frequent crop failures has the lowest rainfall in the presidency. The major portion of the rain is received in sudden downpours. Half the rainfall of the year is obtained between August and October and it rarely rains after the staple crops are sown. The undulating nature of the land, the high clay proportion (58%) in the soil and the sudden, heavy downpours—all contribute to the impoverishment of the land and to the low absorption of water in the soil, consequent on heavy losses by run-off. As rains are rarely received during the growing period of crops, the plants have to depend mainly on the moisture retained by the heavy clay soils. The huge losses of water due to evaporation from the surface of the soil coupled with that due to transpiration of the young shoots, desiccate the top soil quickly. As a consequence there is a shrinkage of the soil and a very

hard layer, 6" – 9" thick, develops below the top 2 inches of loose, friable soil layer. This hard layer affects crop growth as described below.

Moisture, the determining factor. Moisture seems to be the controlling factor in determining the occurrence of the hard layer. When the moisture level goes down below 10 per cent. in the top soil, the hard layer is formed. This layer is so hard that it is difficult to work a plough in it. It is slightly lighter in colour and stands out prominently in any soil profile. That it is chiefly the result of physical processes, viz., drying out of the soil, is demonstrated by the fact that the hard layer disappears when the soil moisture is increased by natural or artificial rain. By drying out a moist soil near field capacity (with the aid of trenches a foot deep dug on either side) it has been possible to induce the development of the hard layer.

How the hard layer affects the roots of crops. In the early stages of the crop, either in sorghum or Setaria, the seedling depends for its nourishment on the seminal root and one or two adventitious roots. When grown up, the plant is entirely dependent on the numerous adventitious roots that arise from the basal nodes of the shoot. These roots, which are so essential to the growing plant, are unable to pierce this hard layer and dry up in various levels developing a purple colour. Instead of penetrating into the soil, they trail along the surface, developing short, stubby root-ends. All types of abnormalities are noticed in the roots in their efforts at effecting an entry into and through the hard layer. What little growth there may be in the shoot, is due to the nutrients derived from the seminal root and the few adventitious roots that have already ramified in the deeper moist layers before the top layer hardened.

An interesting feature noticed in the nodal roots (in sorghum) which could not penetrate the hard layer is the development of innumerable root-hairs all over their surface giving them a silvery, woolly look. Normally in sorghum, the aerial adventitious roots are devoid of root-hairs. Root-hairs develop only when the roots pierce the ground and come in contact with moist particles of the soil. The occurrence of root-hairs all over the entire root, which is aerial, is rare. The root-hairs are healthy and full of protoplasmic contents. The disposition of the root-hairs on these aerial roots lends support for the suggestion that they are developed there in response to moisture which is furnished by the dew of the early hours of the mornings of November—December. This unusual development of root-hairs strongly suggests the extreme efforts on the part of the plant at obtaining water which it badly needs in a dry season (1938).

Even deep tap-rooted plants, like cotton, suffer. The soil, as it hardens, strangulates the tap-root encased in the hard layer with the result that the root region above the hard layer enlarges into a swollen, calloused base (Plate). The root below the hard layer is normal. The degree of hardening of soil seems to vary as is evidenced by the differences in thickness of the strangulated tap-root in the hard layer. Cotton plants may be severely stunted or even killed when their roots are choked in the hard zone.

Constriction of the tap-root of Cotton plants
in the hard layer.

That this ecological disorder is purely mechanical is demonstrated by producing these abnormalities artificially. This was done by enclosing the root between two thick metal plates and screwing them up tightly When pressure was applied to tap-roots for 25 days before the flowering phase, it was found that the growth rate of the shoot in the experimental plants was reduced to a fourth of that of the un-treated. As the plant grew, the stalk bulged out over the treated portion and formed an enlarged, calloused base. The structural deformities noticed in the expreimnental plants were similar to those of the affected plants in the field. When this pressure was applied in the late flowering stages for a similar period as before, no appreciable reduction in stem growth was seen. Nor did the stalk develop the enlarged, calloused base, though the treated portion of the root was strangulated into a flat structure. It has also been possible to induce constriction in roots of cotton plants by artificially drying out the top soil by digging trenches on either side of the plants. All these observations go to prove that the causal factors are purely mechanical.

The inception of the hard layer The inception of the hard layer depends upon the amount and distribution of rainfall in any reason. If the rains are deficient the hard layer is ushered in very early in the life cycle of the plant. Then it effectively stops the penetration of roots or strangulates them destroying the tissues of the root. In seasons of good rainfall, the hard layer occurs only late in the season when the crops are nearing maturity. It does not affect crops in this stage, as the rootsystem is well developed and established in the deeper moist soil. Together with the development of wide cracks, the occurrence of the hard layer probably hastens the ripening of the crop. The deterioration of normal plants into earless plants—locally known as *Jadu choppa*—is also due to the presence of the hard layer. It has to be remembered that the occurrence of a hard layer is a normal phenomenon in the black soils of this tract. Under favourable conditions the farmer need not worry about it as it occurs only in the very late stages when the crop is well established but if it occurs in the young stages of crops, as in years of scarcity, he has to dread it most, as it involves serious consequences.

Remedy. So the chief concern in Dry Farming research in this tract is to eliminate this hard layer. Though bunding and following, which conserve moisture in the soil, may ease the situation a little by postponing the formation of the hard layer, other cultural methods which destroy it have to be devised. From the plant end, this trouble can be circumvented by producing a plant which develops an efficient root-system fairly quickly so that it has an elaborate root-system in the deeper zones of the soil before the formation of the hard layer in the top soil. To meet this end, short duration economic varieties have to be produced. An attempt in this direction has already been made by crossing the early and economic varieties of U. S. A., the *Milo* and *Wonder* with local sorghums. F_1 plants have been produced. Early, economic strains satisfying the above conditions will be developed from the progenies of these crosses. But in any

efficient handling of the situation, this problem has to be tackled from both the plant and soil end.

Summary. The crops fail in the Bellary tract due to the formation of a very hard layer 6"—9" in thickness below the top 2" of friable, loose soil, which cuts off the available moisture in the deeper layers. This hard layer prevents the later formed adventitious roots, which are so essential to growing cereals, from penetrating into the deeper moist layers of the soil or strangulates the tap root at the base of the stem in dicotyledonous plants, interfering with the translocation of water and nutrients to the shoot, which results in reduced growth or complete wilting of the plant. The inception of the hard layer depends upon the amount and distribution of rainfall in any season. In dry years it forms very early in the life history of the crop due to the depletion of the moisture in the top soil by evaporation and transpiration and, in such seasons, the crops completely fail. In favourable years it forms towards the later stages of the plant and hastens the maturity of the crop by reducing the water supply. This hastening of maturity is further helped by the tearing up of lateral roots during the development of cracks. Evolution of short duration varieties which form an elaborate root-system sufficiently early so that they can circumvent the hard layer, when it forms, is suggested.

Acknowledgment. This work could not have been undertaken but for the generous financial aid of the Imperial Council of Agricultural Research, to whom our thanks are due.

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The Cultivation of Cambodia Cotton in the Central Districts.

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In most parts of the central districts of Nellore, Chittoor, Chingleput and the two Arcots, (South and North), the ryot usually raises on his wet land a dry crop of *ragi* or *cumbu* or *cholam* during the *Puvvasi* season, (June—August), followed by a crop of paddy during the *Samba* season (September—January). In case he does not raise a dry crop during the *Puvvasi* season, he raises a crop of *Swaranavari* paddy, followed by a late *Samba* paddy during the *Samba* season. The raising of the *Swarnavari* crop depends upon a copious and unfailing supply of water from his wells. Raising of two paddy crops is an exception, rather than the rule.

In garden and dry lands, which go by the name of *Thottakkal* and *Punja*, two dry crops are raised in a year depending upon the resources of the ryots and wells at their disposal—normally a groundnut crop, and another crop of *ragi*, *cumbu* or *cholam*. On *Manavari* lands, which depend mainly on rain-water, he could raise only one crop such as horsegram, or rainfed groundnuts.

From the foregoing account of the main crops raised in this tract, it is evident that "money crops" are conspicuous by their absence, and the only crop that can be called as such is the groundnut. The ryot has to depend only on this crop, to pay the heavy assessment on his lands, to clear his debts, to celebrate the marriage of his sons and daughters, to purchase his agricultural implements, and clothings for the members of his household and incur other miscellaneous expenses.

Let us contrast the cropping scheme of the ryot of the central districts, with that of his *confrere* in the cotton growing tracts of Coimbatore. In addition to the crops which are raised in these parts, the Coimbatore ryot raises other crops, which will give him more money, and to this end, he so divides his land, and time, that he in addition to growing paddy, *ragi*, *cumbu* and *cholam*, makes it a point to grow some of the money crops like cotton, chillies and tobacco. During my visits to the Coimbatore district, what struck me most was the presence of at least one of the "money crops" in the holdings of every ryot, even of moderate means. I have heard of instances where one ryot near Coimbatore is normally making in the neighbourhood of Rs. 20,000 every alternative year, by growing cotton alone and Rs. 12,000 from tobacco. And it is no wonder, that the Coimbatore ryot after he has taken to money crops, especially cotton, is economically better off than our ryots, who depend mainly on paddy, groundnut, and *ragi* for their income. In passing it may be stated, that the Coimbatore ryot, works under a great handicap, viz., baling out water from wells which are 40 to 50 feet deep, the construction of the well itself costing him Rs. 2500 to 7000.

It strikes me that the best and easiest way to improve the economic condition of our ryots, is to copy the example of the Coimbatore ryot, and cultivate some of the money crops like cotton, chillies and tobacco, depending upon the facilities at their command. Of the above named crops, Cambodia cotton, as will be explained below, can be successfully raised by our ryots.

Varieties of cotton. There are many varieties of cotton grown in the southern part of our presidency, viz. *Cambodia*, *Uppam*, *Nadam* and *Karunganni*. Cambodia cotton is undoubtedly the best of all the above. The yield is greater and the cotton, being capable of producing yarn of a good quality, and of higher counts suitable for weaving cloths of fine varieties, commands a higher price than any other variety. While 1000 lbs of cotton kapas of other varieties except Karunganni yield 250 lbs. of lint, 1000 lbs. of Cambodia kapas yield 330 lbs. of lint, an increase of nearly 25%.

Is it difficult to grow? Being a new crop, the ryot who is generally conservative by nature, relying on age-long practices, and tradition of the village, handed down to him from his ancestors, may have a lurking fear that raising of Cambodia cotton requires a highly technical knowledge. But this is not so. The cultural operations for cotton are the same as those for *ragi* or *cumbu*, and the ryot can, without any extra knowledge or trouble,

raise a high-yielding crop of cotton. What are required for the raising of this crop, are the same old bulls, which he is maintaining; the usual kind of ploughing, and inter-cultivation; but the only difference lies in harvesting, and nothing more, except a possible scare, that it is a new crop. He may have another legitimate fear, that the raising of the cotton crop, may result in the dislocation of his cropping scheme and rotation of crops. On garden lands, cotton takes the place of the crops grown during the period, September to April, and as such he can easily arrange his cropping scheme. Cotton is normally a eight months crop, and after cotton is harvested in April another crop of *ragi* or *cumbu* or some other crop can be raised in June—August season, in case he is particular of two crops.

Is it profitable? Another point, probably the most important point, on which the ryot would like to be fully enlightened, without the least shadow of a doubt, is the financial aspect. Is it more profitable to raise this crop in preference to paddy, *ragi*, *cumbu* or groundnut? It may be stated at the outset, that the average yield of paddy from one acre of land is about 15 bags (1000 *Madras measures*) giving a gross income of Rs. 75, the income from *ragi* is about Rs. 60, from *cumbu* about Rs. 50, and Rs. 70 from groundnuts. In the case of Cambodia cotton, the yield from one acre of medium fertility, will be about 1250 lb., giving a gross income of Rs. 125 at the lowest possible market rate, while highly fertile lands will yield anywhere from 1500 to 2000 lbs. giving an income of Rs. 150 to Rs. 200. At the present unfavourable market rate of Rs. 28 per *pothi* of 280 lbs., the income can be estimated at Rs. 125 per acre, the normal rate being in the neighbourhood of Rs. 32 per *pothi*.

A perusal of the comparative statements given in the appendix, showing the cost of cultivation of different crops and their yields, will clearly demonstrate that in the case of cotton, a net income of Rs. 90 per acre can safely be expected, excluding the cost of dried cotton stalks while the income from the other crops are even less than half in most cases.

In Government lands, the rent charged is the same irrespective of the crops raised, but in *zamindary* areas, which occupy half the total area of our parts, the rate for paddy is about Rs. 25 per acre, while the rate for cotton will be on a par with *ragi* and other pulse crops in the neighbourhood of Rs. 5 per acre.

On an average, an acre of cotton stalks, will produce firewood, weighing about 4 tons, or roughly 160 headloads. The cost of a headload of Casuarina is about 5 annas, and cotton firewood can be sold at 2 annas per headload, thus giving an additional income of Rs. 20 per acre. The dung that is now converted into cakes and used as fuel, can profitably be replaced by cotton stalks, and thus increase the available supply of farm-yard manure. Cotton stalks from one acre will supply firewood for a family of five persons for five months.

Irrigation. While copious and continued irrigations are required for garden land paddy, and at least eight irrigations for *ragi* and irrigated

groundnuts, only seven irrigations are required under normal conditions for cotton. Under the worst seasonal conditions, ten irrigations will be sufficient for the crop.

Where a well can command 2 acres of paddy and 3 acres of garden crop, 10 to 12 acres of cotton can be raised with the available quantity of water from the very same well.

The shedding of leaves from the cotton plants result in increasing the fertility of the land, while the raising of crops like paddy etc., have the effect of removing the fertility of the land. In the latter case, there is no return of manure back to the land while in the former case there is addition, and the decaying leaves, increase the humus content of the soil.

Trial of Cotton. At the instance of the Madras Agricultural Department, the writer grew Cambodia cotton in his fields at Nagari, Chittoor district, in a plot of $1\frac{1}{4}$ acres in the year 1936. Unfortunately, in spite of the advice of the departmental officers, a low-lying plot was selected half of which was subject to waterlogging, during the North East monsoon rains, with the result that intercultivations could not be done in that portion till the end of November. This was responsible for the stunted growth of the plants, and the local ryots were of opinion that it was only a ten-anna crop. Owing to the very favourable price then obtaining Rs. 36 per *pothi* of 280 lbs. a net income of Rs. 140 was realised. In subsequent years owing to the fall in the price of cotton (Rs. 28 per *pothi*) the writer was able to realise a net income of Rs. 90 to 100 per acre, depending upon the market price of the commodity. The average yield per acre was in the neighbourhood of 1250 lb. The ryots were so much convinced about the income from cotton that about 30 to 40 acres are now under cotton round about our village and in our taluk. They are definitely of opinion, that it is certainly very profitable to grow *cotton*, in the place of *groundnut*, *cumbu* or *ragi*. The joy of a poor ryot who realised Rs. 150 from his $1\frac{1}{2}$ acres of land knew no bounds. Another ryot, who sowed cotton in $3\frac{1}{3}$ acres at the end of September 1938, has so far realised Rs. 320 out of 2 pickings and the third picking is expected to give him at least another Rs. 100.

The growing of a new crop was too much for the ryots and specially to my father, a born businessman, who by training and habit, always thinks in terms of Rupees, annas and pies. I turned a rebel and sowed cotton. He would not and others too would not look at the crop. But lo ! what a change after 9 months. A money order for a lump sum delivered straight into his hands from the Tiruppur cotton trading society took him by surprise. Cotton is something of a wonder now. More than Rs. 100 from an acre ! The businessman in him, now asserted itself. He wants now not one acre under cotton but at least 10 acres yearly. That is the magic which cotton has played on him and I fondly hope that its spell would convert others too.

Appeal to the Ryot. The economic salvation of the ryot depends upon the help that he may receive from outside against and upon his own efforts. The formation of the Debt Conciliation boards, the starting of Loan

and Sale Societies and the Land Mortgage Banks, the passing of the Debt Relief Acts, intended to alleviate the distress of the ryot, come under the first category. But adopting the suggestions of the Agricultural Department, by using improved implements, and cultural operations, raising crops of approved and better strains, and growing money crops like chillies, tobacco, cotton, sugarcane, and plantains, depend upon his own actions. The help of outside agencies may indirectly help the ryot, but the enrichment of his family and the improvement of his financial status are the result of his own actions, and should he take to Cambodia cotton, it is bound to revolutionise his economic position. For there is no crop which is so easy to grow, and there is no crop which can give him, as much money as cotton can give him, barring of course sugarcane and plantains. While a lot of capital outlay and forty irrigations are required for raising sugarcane, not to speak of constant attention for one full year, and while the yield of plantains depends upon the absence of winds, and a constant supply of water, with a good initial investment for suckers and heavy manuring, cotton alone is unique in that with a capital of 8 annas it can be grown successfully even by a layman like myself, who took to it more as a hobby than as a profession. If the possibilities are so very great under the hands of a novice, much more will be the economic benefit if a practical agriculturist were to become its votary. Raising an acre of Cambodia cotton, is as good as insuring oneself for an income of Rs. 100 per annum, and such a steady annual income is bound to revolutionise his economic position. If you want to clear your debts, raise cotton ; if you desire to free yourself from the clutches of your village *sowcar*, grow cotton. If you wish to provide for your descendants, grow cotton. If you like to celebrate the marriage of your sons and daughters, without borrowing, grow cotton. If you want two square meals a day, and enjoy the fruits of your hard labour and lead a contented life, grow cotton. If there is a *Kamadhenu* on earth it is cotton and cotton alone.

In passing, it may be observed, that before taking to cotton, the Coimbatore ryot was as good or as bad as our ryots. But the growing of cotton gave him sufficient money to clear his debts, and as cotton was responsible to free him from the jaws of his *Marvadi* creditors, the Coimbatore ryot very pertinently christened cambodia cotton as *Marvadi Paruthi*. Similarly during the boom period, the growing of groundnuts enabled the South Arcot ryot to discharge his debts.

In the course of this paper, the experience of the writer has been given and it is his considered opinion that the growing of cotton yields from 100 to 25% more income than from the other crops.

Here is a golden opportunity for educated unemployed youngmen to woo and cajole "Mother Earth" and it is fervently hoped that this paper will greatly enable them to earn a decent income not only for their maintenance, but to improve the economic condition of their families. In these difficult days, it is an herculean effort to secure a job, and improved agriculture on modern lines offers the best possibilities provided the knowledge

gained in the research stations and the advice of the Agricultural department are utilised by our young men. Among God's gifts cotton offers unbounded scope for profit and pleasure.

APPENDIX I. Statement showing the cost of cultivation of crops

Operations.	Ragi.	Cumbu.	Groundnut.	Paddy.	Cotton.
Ploughing	4 8 0	3 0 0	3 12 0	6 0 0	4 8 0
Manuring	7 8 0	4 0 0	4 0 0	7 8 0	7 8 0
Seeds & seedlings	2 0 0	1 8 0	6 0 0	6 0 0	0 8 0
Hoeing & weeding	1 8 0	1 8 0	1 8 0	1 8 0	5 0 0*
Transplanting or sowing	2 0 0	1 0 0	0 12 0	3 0 0	0 8 0
Irrigation	10 0 0	6 0 0	5 0 0	5 0 0†	8 4 0
Harvesting & threshing	2 8 0	2 8 0	12 0 0	4 0 0	7 8 0
Rent	3 8 0	3 8 0	7 0 0	25 0 0	5 0 0
Marketing charges	...	...	...	...	6 4 0‡
Total	33 8 0	23 0 0	40 0 0	58 0 0	45 0 0

* If bullock power *Guntaka* are used, the cost will be only Rs. 2

† Rs. 5 represents only the wages of the cooly for the whole season for attending to irrigation.

‡ Represent the freight charges for sending cotton to Tiruppur.

APPENDIX II. Statement showing net income.

Crop.	Yield.	Value of Grains.	Value of Straw.	Expenditure.	Net Income.
Ragi	12 bags	60 0 0	7 8 0	33 8 0	34 0 0
Cumbu	10 bags	50 0 0	5 0 0	23 0 0	32 0 0
Groundnut	32 bags	70 0 0	7 8 0	40 0 0	37 8 0
Paddy	15 bags	75 0 0	15 0 0	58 0 0	32 0 0
Cotton	1250 lbs.	125 0 0	20 0 0	45 0 0	100 0 0

Each bag contains 60 *Madras measures.*

APPENDIX III. Net gain from cotton over other crops.

	Income from other crops.	Income from cotton.	Difference in favour of cotton.
Ragi	34 0 0	100 0 0	66 0 0
Cumbu	32 0 0	100 0 0	68 0 0
Groundnut	37 8 0	100 0 0	62 0 0
Paddy	32 0 0	100 0 0	68 0 0

SELECTED ARTICLE

A New Method in Mango Propagation.

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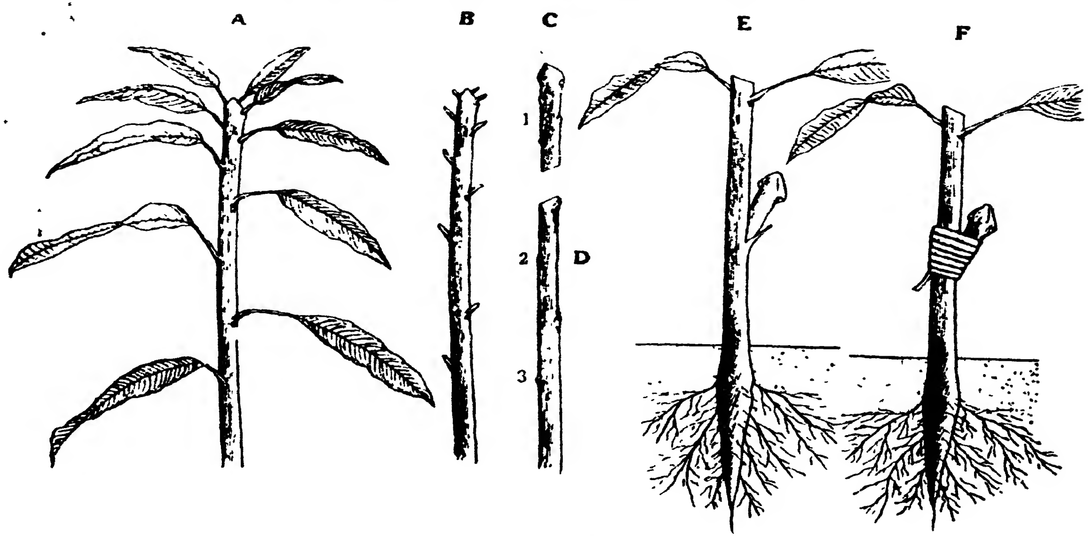
Introduction. Evergreen fruit trees, like the mango, citrus, chico, and avocado, are generally propagated by inarching and marcotting in warm countries, as it is believed that both budding and veneer grafting are not successful in the tropics. The reason is mainly based upon the fact that in cold countries one can easily utilize dormant buds which can be revived by placing them upon a functioning root-stock, while in warm territories it is difficult for the budwood to harden and also the scion or buds used easily dry up with excessive heat before they become

firmly established in the process of union with the tissue of the root stock. Both inarching and marcotting, besides being tedious, cannot be expected to produce a large number of vigorous young plants at one time. The resulting offspring, besides being too large to be moved, thus exposing them to the danger of withering, are always weak and look old. Various methods of twig grafting have been claimed to be more satisfactory. One method is to use the whip grafted scion with a free bottom end nourished by water in tube, or inserted into moist soil. This method undoubtedly keeps the bud alive during a period long enough to perfect the union, but it requires too much labour. "Etiolation layering" is sometimes recommended to secure a large number of vigorous young plants in the tropics, but it is not always successful when the soil and temperature are not ideal. Under this circumstance, a new device for side-grafting in which immature wood is used, is proposed by Ichizo Nakamura of Takao, Formosa. This device works very satisfactorily under tropical conditions in multiplying mango plants in a very speedy way. This new finding is described in the following paragraphs.

Theoretical starting point. In temperate countries where both budding and grafting are practised the scion species used are mostly deciduous and the buds are dormant when cut, as those on immature wood are hard to revive. In tropical countries, in the case of the mango, the development of the bud does not require a long period of dormancy, and soft wood buds can be used for grafting purposes. Moreover, the healing of the wound is much easier when the plant is active in midsummer up to early fall when the temperature is high and the regenerative power is strong. In early spring the temperature is not high and the plant is more dormant than in summer and this gives a different effect to the plant. The root stock to be worked is also larger and more vigorous with the advance of the season and it is easy to force the bud to start strong growth. This supports the theory that spring is not the proper season when to practise grafting in the tropics, since the physiological and morphological conditions of the stock plant are, in summer rather than in spring, far more conducive to make the wound heal faster, force the inserted bud to grow easier, and complete the elongation of the shoot faster. It does not require an entire season to expect a full wood growth, as the growing season is long and the temperature favours a rapid elongation. Another important difference is the evaporation power. Ordinary scions used in the temperate countries in spring are dormant and keep a considerable length of time without losing their power of regeneration as the physiological activity is slow. Scions used in the tropics, on the other hand, are always active and ready to function even during winter, and are ever subject to loss of water by transpiration and respiration. Under this condition, the scion must be properly protected against loss of water, and the budwood must be waterproof as far as possible. To answer this requirement, budwoods must have neither foliage nor petiole, and the leaf scar should be water-tight with complete cork formation after the natural abscission of the petiole. This can be attained by removing the leaf blade at the middle of the petiole, before the scion is cut, and by waiting a week or so, the remaining petiole falls down with the formation of an abscission cork layer. Such wood is ready to be used as a scion. Without doing this, and if the leaves are removed at the time when the scion is cut, the cut surface of the petiole is likely to form a danger point, from which water may evaporate very quickly. Such scion will wither very rapidly and will not survive at all when used. Defoliation and healing of the leaf scar will unquestionably prevent the loss of water by the bud. Not only that. They accelerate the subsequent development of the bud into a sprout. The precuring of bud by defoliation renders the scion ready to start bud growth when used. This point is well explained in Mr. Nakamura's method and the factors which

A NEW METHOD IN MANGO PROPAGATION



Courtesy—Philippine Journal of Agriculture.

Explanation to Illustrations.

A, typical mango budwood.

B, leaves are removed by cutting them off at the petiole.

C and D, natural abscission of the remaining petioles. 1, 2, 3, pieces available for scion. They are to be cut off from the top at intervals of about two weeks, as soon as the cut surface is healed.

E, side grafting on a root stock cut back.

F, the same, tied with narrow thread tape.

cause the failure of grafting in the tropics are wisely avoided and more logical processes substituted.

Method of grafting. In Mr. Nakamura's method, terminal or lateral buds, in an intermittent rest period between two cyclic growths, are to be used. If the terminal bud is wanted several leaves from the top are removed and the scion with two or three leaf scars is to be cut after the abscission of the petiole. The lower portion of the same stick can be used again, after two weeks or so, in the meantime waiting for the terminal cut to heal completely. After removing the leaf blade and the remaining petiole, the top part with several leaf scars can be used, as before, for the scion. This time, the axillary buds in the uppermost position are to be developed. In a similar way, the still lower part of the same stock is available. It is better to remove all leaves of the entire shoot at the beginning, if several scions are to be obtained from the same shoot.

The scion is inserted into the notch made on one side of the immature but fully developed root stock, while the bark is still green. Two or three year old stocks with brown barks are also available but they are not so good as the green ones. Still larger stocks over two centimeters in diameter should be cut back when worked on with young sprouts. When the stock is old and top working is desired, the entire trunk is cut down in early spring at a point 15 to 18 cm. from the ground. From several adventitious sprouts arising near the cut surface, one or two opposite, strong, shoots may be saved, and such vigorous shoots are used when they grow big enough to work on. It does not matter how big the stock is, but the part to work on must not be fully mature and dormant. When working on young plants, the stock is cut at a point 5 to 10 cm. from the ground leaving two or three leaves, which are left untouched when the scion is inserted.

The root stock. The most economic and speedy way is to use one-year old mango fruits, chosen to supply seed for stock, must be large enough in size if the plant is a seedling type, and it must represent a good early strain. It is not necessary to use the seeds of big varieties, like the *Carabao* or *Golek*, because all seedling types supply good stock plant for the standard mangoes. If the *Carabao* mango seedling is used as the root stock of the *White Golek*, the scion will always outgrow the stock, but the stock of the seedling type of the mango will grow just as big as the scion or will slightly outgrow it. The seeds are planted in pots or in the ground 60 cm. apart, after removing the shell. The planting soil must be well prepared and rich in organic matter. After sowing the seeds, it is desirable to have a thin sand dressing on the surface. Upon germination of the seeds, they must be tested to show only a single plant from each seed, and smaller poly-embryonic secondary sprouts must be scraped off while they are young. The seedlings should be well fertilized to allow them to attain their maximum height and girth. In starting the work, the bigger seedlings are to be worked on first, the smaller ones next. The cutting back of the top of the stock must not be carried down too far away from the parts having closer leaf stand. In top-working old seedlings, the best results may be obtained when the plant is rather large, having at least a diameter of 12 to 15 cm. That transplanting may be made easier the seed should be planted in a longitudinally halved pot.

Operation and tying. The bottom of the scion must be cut very sharply to make an acute wedge, but one side must be cut along the cambial layer as far as possible, so that both sides are not asymmetrical. The cut surface must be very smooth, allowing a single draw of the knife to make an even plane. The stock is then notched by cutting it down diagonally, and the knife must be drawn straight down to make the oblique cut very sharp and even. The side to be incised must be as straight as possible. Curves should be avoided. It is preferable to work on the eastern side, as the after-noon sun may injure the graft

when it is done on the western side. The wood tissue should not be cut too deep into and incision must not be too far away from the cambial layer. The scion wedge to be well placed must be inserted in air-tight contact with the incision surface. The tongue-like portion of the bark must not be broader than the stock notch, even if the scion is thicker than the stock In other words, the cambial plane of the former must be completely concealed within the incision of the stock. All precaution must be taken to make the scion wound perfectly covered by the cut surface of the stock. The air-tightness of the contact surface would decide whether the union is successful or not. A long exposure of the cut surface of the scion must be kept during the operation, in a tall box to prevent its cut surface drying up The best kind of knife to use in mango grafting is one having a blade of stainless steel and sharpened on one side only. By using such a knife, oxidation of the surface can be prevented. The sharp edge of the knife must be straight so as not to cause any curvature on the cut surface. The best type of tying material is ordinary cotton string tape commonly used in the shop which is composed of several thread lines pasted flat in one narrow strip. The tape must be wound close and tight so as to exclude air. Such tape will be removed one or two months after the taking of the scion when it will have increased in volume. Waxed cloth tape generally used in budding is not satisfactory, as it prevents the quick swelling of the scion in action.

Treatment after operation. No cover is necessary to protect the graft even in strong sun-shine. After two weeks, the uppermost bud of the scion begins to swell. If it looks difficult to judge whether the graft was successful or not, observe at night with the use of a flashlight. The surviving scion looks lustrous and turgid. After the third week, the bud starts its initial growth. The internal activity of the living graft can be easily detected with the frequent visit of ants, seeking the sugary secretion of the new growth. At this time, the top of the root stock may also show new growth. These stock shoots must be shaved off with care as soon as they start to elongate. When the new growth of the scion develops and reaches a length of 30 cm or so, the remaining top portion of the stock must be sawed off carefully at a point 5 to 8 mm. above the union.

If the scion did not take, the same stock can be worked again at the opposite side a little below the original incision.

Since no cover is used in the present method, precaution must be taken not to leave any wound of the scion in contact with the air. The success of the graft is therefore dependent upon the skill of the operator. Covering the grafted portion with soil helps injurious fungi or bacteria to the wound.

Discussion. Mr. Nakamura's side-working method of the mango is a good example of " soft wood grafting " which is generally believed unsuccessful in the tropics as well as in the colder countries. He found that the failure lies principally in the inadequate condition of the scion, and the lack of proper attention to safeguard its activity. The immature bud does not develop in most of the temperate species, except in a few, like the apple, plum, and the cherry. With most of the tropical species, however, it is easier to make such immature bud start growth, provided the forcing is done effectively. This can be attained by pre-curing the bud through defoliation and putting it into a vigorously growing stock during the active growing season, not in the springtime when the bud is semi-dormant. The strong seedling cut in summer or early fall can easily stimulate the inserted bud to growth, after a certain period of curing caused by the natural drop of the petiole which, in turn, is forced by the removal of the blade. At the same time the scion is almost water-proof as the petiole scar is already well coated with cork tissue thus preventing evaporation. All these factors favour the rapid healing of the union and the easy development of the new bud. At

the end of the fall, an already well developed nursery plant can be secured and a large number of similar plants will then be available as a good supply of the budwood can be had at intervals of approximately two weeks, as stated in the preceding paragraphs. The entire grafting work is complete at the end of the year the seeding of the stock plant is started and the resulting young plants are ready to be transplanted in the next spring. In this way standard varieties, like the *Carabao* and the *White Golek*, can be obtained in a large number within a very short time. This gives an opportunity to mango planters to raise more plants of the desirable variety with less expense and labour. This fact also suggests the possibility of the mango trees being planted on a large scale as a plantation crop, since the demand for fresh fruits has increased after the invention of preparing the frozen mango meat for use in ice-cream manufacture. The canning of the mango meat is also a great possibility in tropical countries. Fruits of such varieties like the *Carabao* and the *White Golek* can be picked green before the mango fruit fly (*Chaetodacus dorasalis*) Hendel has a chance to attack them. They can then be satisfactorily transported and marketed before they get overripe. It is hoped that the present paper may be of help in the future development of the mango industry in the Far East. *The Philippine Journal of Agriculture* Vol. 10 No. 1, 1939.

Cotton Cultivation in Italy.

(Translated by N. K.)

The cultivation of cotton is confined to the warmest portions of Italy viz Southern Italy and Sicily, which was once considered the main mine of "White gold" for Europe. In 1864 more than 88000 ha.[1] of land was under cotton, with a return of about 200,000 dz.[2] of lint. Owing to the competition from the tropical countries and the small encouragement from the then government the cultivation gradually fell down till ultimately it practically disappeared. About the beginning of the present century it was only 2000 ha. which rose during the war to 10,000 ha. In 1930 it went down again to 3361 ha. and in 1934 to 2958 ha.

The period from 1936 onwards saw a regeneration of the cultivation of this crop:—1936—9638 ha. with a yield of 18,580 dz. lint and 3760 dz. of seeds; 1937—23,681 ha. with 59,212 dz lint and 17,602 dz. seeds; and further the cultivation extended in Southern Italy from 11 provinces in 1930 to 24. It was calculated that in 1938 owing to the activities of the propoganda organistations, which are interested in all fibre plants, the extent of cotton cultivation to be at least 40,000 ha. In the last five years Italy has imported cotton to an extent of 2 million dz. which amounted in value to about 1-2 million Liras.

Varieties, climate and soils. Almost all the seeds sown in Italy are traceable to the crosses of *Gossypium herbaceum* X *G. barbense*. *G. arboreum* follows as the second and even as the third, while the *G. religiosa* is of no account in Italy.

The most widely spread and patented sort in Southern Italy is called 'Acala". Then numerous other sorts: Nostrale di Terranova; Nostrale di Sciacca; Biancorizzo; Biancavilla; Bianco di Castellammare; Gentile Maltese and hybrids with the Egyptian "Sakellaridis". But the long staple Egyptian varieties which are descended from the Sea-Island cottons are unfortunately of little importance on account of the unfavourable climatic conditions.

The experiences in the cotton cultivation from 1850 to 1865 have shown that this plant could be with advantage cultivated in Southern Italy. In Bulgaria itself this plant thrives very well and in Jugoslavia 64,000 ha. are set apart for this crop while in Greece the yearly cultivation runs to about 200,000 ha.

1. one hectare = 2·47 acres; 2. one doppelzentner = 1 quintal or 2 cwts.

In Southern Italy regions from about 200 to 500 meters[1] above sea level and lying in advantageous positions are to be preferred for cotton. Under 200 m. it flourishes very well every where so long as it is not caught in the late frost. The best suited are the middle-heavy, alluvial soils, and experience has shown that this plant could be cultivated with a fairly good yield, in heavy, somewhat saline, and also on very light soils provided the suitable cultural methods are employed. Only very steep, stony and highly calcareous, very dry or water-logged soils are not fit for this crop.

Irrigation is not unavoidable. In Russia the land under cotton was increased five-fold in that a land which was not suitable for irrigation was also put under this crop.

From the 20,000 ha. which was under cotton in the year 1937 in Sicily only 3000 ha. could be irrigated. Certainly an irrigation in the dry spring season for ensuring the germination and towards the time of the first flowering would be very helpful. Excepting in the very light soils irrigation from August onward is injurious as it would prolong the ripening. The early ripening is very much wished for, for it has a very special importance, thereby the harvest would be ended within October, or at the latest in the first half of November thus making place for the wheat which follows it.

Preparation of the field. Cotton prefers a good well worked soil, which during the period of the crop must be harrowed three or four times to keep it free from weeds. Manuring: A good stable yard manure from 100—150 dz. per ha. is very good. Phosphoric acid (6—8 dz. superphosphate 16/18%) and potassium (100 to 200 Kg. of sulphate) should invariably be added, since these increase the yield and ginning percentage. P. improves the quality and improves what is very important—the ripening; K. makes the plants resistant against diseases specially rust attack. N. should be used in very poor soils and always with great care.

In the case of the dry fields the manure should be ploughed in, in the early spring but in the irrigated fields it could be done a few months later.

Sowing. The time of sowing depends completely on the rain and the moisture conditions. In general it is conducted in rows 80—100 cms. apart. The seed rate is 15—18 Kg. per ha. from which only 2/3 is at first sown so that any gaps in the germination may be later filled up by the remainder.

The first weeding is soon after the germination and the second at the beginning of June when the seedlings have 6 to 8 leaves. During the further growth of the plants the soil must be periodically worked so as to keep out all weeds. Unwanted side branches must be removed and in the beginning of September the plants thinned out to promote the growth and ripening of the capsules.

The harvest begins 15 to 20 days after the opening of the first capsule and takes about a month's time. Normally three harvests are done, but 50% of the yield and also the most valuable portion of the crop is obtained in the first harvest. A higher price is paid for this, for from this the seed for the next season is reserved. Then follows still two further harvests and towards the end of Autumn latest in the second half of November, all such capsules that are not yet ripened are removed and dried in the sun or in ovens to induce the capsules to burst. But the lint obtained by this method is very poor.

Sicily produces in general the best lint (better than the one obtained in America from the same variety) They can be classified in the "good strict middling" group, when it is not spoilt through watering and careless harvesting.

The opinions as to the methods and quantity of manuring is divergent. Various workers, however, come to the conclusion that stable yard manure

1. 1 metre - about 3⅓ feet

has got a good effect only when it is applied early enough and ploughed in, that N. as artificial manure may be used with special precautions and in calculated quantities and superphosphate and potassium sulphate give mostly good results in that they not only increase the produce but also improve the quality.

In order to extend the acreage under cotton an important research scheme has been laid down by the *Comitato Nazionale per l' incremento delle concinazioni* in Rome. This experiment will be tried in various important provinces particularly in Southern Italy and Sicily. *Die Ernaprung der Pflanza* 35 (1939) : 146.

EXTRACTS

A New Microscope. Prolonged tests have now proved that the super-microscope, recently demonstrated to the public of New York, is an instrument of immense practical value. There is every possibility that it may go down to history as the outstanding invention of the twentieth century. Tiny disease germs that are quite beyond the range of the ordinary optical microscope have been photographed with clarity and detail. The super-microscope has opened up an entirely new field in the science of bacteriology, and that is only one aspect of its usefulness.

The basic limit of the optical microscope was reached years ago, although minor inventions and ideas have improved it in certain specialised directions. The limit of the ordinary microscope is governed by the wave length of light, which is far too coarse for the purpose of investigating the world of the infinitely little. Light waves are about one fifty-thousandth of an inch long. The germ is small enough but there are many things much smaller. The germ that causes measles is a typical example; it cannot be identified by an optical microscope.

The new microscope uses electrons instead of light, and if there is anything smaller than an electron, science has yet to discover it. The idea of using electrons for detecting very minute bodies was talked about ten years ago but the method eluded the research workers until 1932 when Professor Ernst Ruska of Germany announced that he had invented a machine on paper. He began to build models to prove that his theories were correct. To-day his first working super-microscope is producing extraordinary results, and no doubt these will be regarded as crude and coarse when the new instrument has been perfected.

The apparatus looks more like a machine than an optical instrument. It stands higher than a tall man and gives the impression of a howitzer with knobs on. Inside the central metal tube a vacuum is maintained so that the electrons meet with no resistance as they go about their work. Air molecules would be too coarse a medium for the electrons to operate in. Attached to the tube is an instrument panel studded with dials and controls to enable the operator to keep in strict harness the 80,000 volts of electricity required to set up a stream of electrons.

The basic idea of the super-microscope is simple enough. A narrow beam of electrons is made to pass through the object being studied. The beam is then "coned" out to give an amplified image. In ordinary microscopes amplification is obtained by lenses which bend the light out of its natural path. Glass lenses are useless for electrons because glass is not transparent to them in the sense that it is to light. The super-microscope uses magnets and induction coils to establish electric fields of force at strategic points. These pull the narrow beam into a cone-shaped mass of flying electrons and at the base of the cone there is a screen on which the electrons impinge.

The beam of electrons shoot downwards, at nearly 100,000 miles a second, through a small aperture near the top of the machine. Magnetic fields ' waist " the beam to an incredibly small diameter at the point where the object under examination is placed Let us suppose that a group of bacteria is being studied. Some of the electrons are stopped by the denser portions of the bacteria. Others pass unchecked through the more transparent parts. Once the beam, or what is left of it, has passed through the object, it is fanned out in all directions at once and equally. Eventually, the everwidening beam strikes a screen which is coated with a chemical capable of converting the impact of each electron into a point of light.

The observer looks through an eyepiece in the base of the machine and sees a televised half-tone incredibly magnified of the object under study. The super-microscope has already photographed bacteria 20,000 times larger than life, whereas the optical microscope's limit of magnification is 2,000 times larger than life. As a beginning this is no mean effort. Given sufficient capital it would be possible to build a super-microscope as tall as a skyscraper and with it to magnify germs to the size of elephants. Theoretically there is no limit to the degree of magnification possible.

All kinds of people will want to use the super-microscope. With its help textile experts will be able to devise new fabric and to improve existing ones. Metallurgists may discover in it the 'philosopher's stone' of the ancient alchemists, the magic instrument that will enable them to convert one metal into another by the simple process of re-arranging the atoms. Scientific detectives will unearth new sorts of clues with its aid. Even brewers may use it to study more closely the mystery of fermentation. Biologists need it badly for the study of genes, the infinitesimally tiny things that determine whether a person shall have brown hair, blue eyes, and so on. Genes are so small that a five-grain aspirin tablet would be large enough to contain all the genes necessary to determine the heredity of the next two million babies. Chemists need the super-microscope for the closer study of complex molecules, both for industrial and health purposes. The mystery of cancer may at last be probed by the new eyes. There are endless possibilities

The electron microscope has its limitations. The optical instrument can study things alive and can often watch harmful bacteria at their fell work. The electron beam is a death-ray that kills anything left alive by the vacuum in which it works. This is not a serious handicap; the facts of an organism's life may perhaps be reconstructed by obtaining many photographs of it in death. In any case, the super-microscope taps a world that is largely below the scale of life as we understand it, that indeterminate field between the organic and the inorganic. However, the electron microscope will never be able to reveal the secret of life itself.

A new era Intense interest has been aroused among scientists by the news that Dr. Vladimir Zworykin's new "ultra microscope," said to be capable of magnifying up to 1,000,000 times, has been demonstrated at Richmond, Virginia. There is certain to be considerable controversy about the nature of Dr. Zworykin's apparatus. Some students of microscopy hold that it is not a microscope at all. That question, and others concerned with Dr. Zworykin's claims, will be raised shortly at a special meeting of scientists in London.

"It is contemplated," Dr. Clarence Tierney, Secretary of the Royal Microscope Society, told an *Observer* representative recently, "that Dr. Zworykin's new apparatus shall be thoroughly discussed at a meeting of the society. It is difficult to make any definite statement until the matter has been thrashed out at that discussion."

Bacteria Seen. Dr. Zworykin's instrument uses electrons instead of light. The objects magnified are projected on a fluorescent screen. At the demonstration bacteria never revealed before were shown to a large audience of scientists and technicians.

Those who say that the apparatus is not a microscope point out that according to reports the images shown by it are not "resolute". They are more like the outlines thrown by a shadowgraph, or the objects revealed by X-ray photography.

To this others object that the apparatus is performing a function beyond the scope of any microscope. They argue that even if the ordinary microscope uses ultra-violet instead of ordinary light rays, it is limited to certain wave lengths. Nothing smaller than these light waves can be shown. In other words, the microscope, as we understand it, has reached the limit of its usefulness, or the limit of smallness in the forms of life which it can reveal.

Revolutionary Apparatus. Although it may not have the precision of the ordinary microscope, Dr. Zworykin's apparatus probably reveals, at any rate in outline, forms of life and energy which have not hitherto been visible at all. One of its uses, if it can show ordinary molecules with sufficient accuracy, may be to do away with the need for elaborate X-ray study of large and complicated molecules. Dr. Zworykin, Director of the Electronic Research Laboratory at Richmond, was closely associated with the invention of the television camera. Indeed, his new "ultra microscope" is allied technically to the ordinary television camera. The electrons emitted by the object to be studied are focused by a powerful magnetic field and the focused image, much magnified, is shown as in the television receiver on a fluorescent screen. (*Indian Forester*, Vol. 65: (1939) 297—300.

Agricultural Jottings.

TIRUVOTTIYUR MILCH CATTLE MARKET

Tiruvottiyur, six miles to the north of Madras on the Madras—Waltair section of the M. & S. M. Railway, is the main market which supplies milch cattle to the City of Madras. The import of cows and milch buffaloes to this market ranges from 12,000 to 15,000 annually, and the daily average arrivals amount to four to five wagon-loads or 32 to 40 animals. Cows are brought from the Ongole breeding tract as well as from the contiguous taluks of Guntur and Nellore districts. These two districts supply also buffaloes. Practically all stations from Nellore to Tenali are booking animals but the important ones are Tanguturu, Ongole, Tenali and Singarayakonda.

Tiruvottiyur is a daily market and one can see about 250 animals assembled there in the slack season from March to August and about 400 in the busy season from September to February. Roughly a little more than half the number of cattle is cows chiefly of Ongole breed with a few cross-breds, and the rest are country buffaloes. Of late, Delhi (Murrah) buffaloes are coming to this market from the Punjab and Central India from July to December.

Milch cattle trade is in the hands of *dalaries* or cattle dealers, who go to the producers in the tract and purchase cows and buffaloes with calves at foot or those nearing parturition. Money is usually paid to the producer in cash but sometimes credit transctions also take place if the dealer is known. The dealer collects the animals to the nearest railway station and books them to Tiruvottiyur where he offers them for sale.

The market at Tiruvottiyur is a private one and the dealer is permitted to construct a shed at his own expense wherein he lives and no charge is made for it. The only charge he has to pay the market owner is Rs. 2—4—0 for a wagon-load of eight animals. The animals can be kept in this market till they are sold. Sales take place chiefly through brokers. If a purchaser wants a cow, the broker takes a rupee from the purchaser and pays it to the dealer which betokens the commencement of negotiations The broker and the dealer then start bargaining. If the bargain falls through, the rupee is returned, but if it is concluded the purchaser has the option of revoking the bargain if the animal does not yield the specified quantity of milk at the purchaser's place. For this test, the purchaser has to pay a rupee to the dealer and another to the cooly to deliver the animal at the purchaser's place. In case, the animal is not up to the mark, it is returned and the purchaser loses three rupees paid in the transaction. If the animal is purchased the broker gets one rupee from the purchaser and from Rs. 5 to 10 from the dealer. The prices generally range from Rs. 100 to Rs. 150 for an average milking cow and from Rs. 150 to Rs. 200 for a good milking cow. Prices of buffaloes range from Rs. 80 to 120 and from Rs. 120 to Rs. 150 respectively. Poorer milkers are available at cheaper prices. Out of the prices realised at this market, it is computed that about 60 to 65 % goes to the producer; the expenses under collection, transport, labour, market charges, feeding, brokerage etc. amount to about 20 % and the dealer's profit is 15 to 20 %.

Various concessions have been obtained for this trade from the Railway Company. The terminal charge of Rs. 4 per wagon at Tiruvottiyur has been removed. Railway freight for dry cows from the City to grazing areas has been reduced by 50%. This has reduced considerably the chances of dry cows falling into the hands of the butcher. Calves of dry cows were charged separately during the return journey till recently. But now they can be carried with the mother without any extra charge.

The market is very important to Madras City from the milk supply point of view. Hence market intelligence relating to supply, demand and prices is a great desideratum. The producer will know the prevailing price at Madras and thus dictate his own terms to the dealer. This will reduce the middleman's profit to the producer's advantage. Such news service is not available now for any cattle market and a start is being made with this market and it is hoped that weekly notes will be published hereafter.

Tiruvottiyur Milch Cattle Market.

Madras, Friday the 28th July 1939.

Arrivals and stock of country buffaloes are on the increase. Fine buffaloes of the Delhi breed are arriving. Trade in cows continues to be dull. Prices stationary.

The following gives the stock movements during the week ending 28th July 1939.

	Stock at commencement.	Arrivals.	Sales	Balance at end.
Cows-Ongole	82	98	93	87
Cows-cross bred	2	...	...	2
Buffaloes-country	92	118	37	176
Buffaloes-Delhi	18	16	7	27

Prices:

Age.	Milk yield.	Prices from	to
1. *Cows-Ongole.*		Rs.	Rs.
1st and 2nd calving	2—3 Madras measures.	100	120
	3—4 ,, ,,	120	140
2nd and 3rd calving	2—3 ,, ,,	60	90
	3—4 ,, ,,	90	100
2. *Buffaloes-country.*			
1st and 2nd calving	2—3 ,, ,,	70	100
	3—4 ,, ,,	100	120
2nd and 3rd calving	2—3 ,, ,,	55	70
	3—4 ,, ,,	70	80
3. *Others.*			
Buffaloes-Delhi		150	200
Cows cross-bred		150	200

1 Madras measure = 4 pounds.

Tiruvottiyur Milch Cattle Market.

Madras, Friday the 11th August 1939.

Owing to demand for milk, sales are improving, arrivals of Ongole cows are increasing, but not adequate; whereas buffaloes are arriving in large numbers. Prices do not show any tendency to fluctuate.

The following gives the stock movements during the week ending 3rd August 1939.

	Stock at commencement.	Arrivals.	Sales.	Balance at end.
Cows-Ongole	87	86	103	70
Buffaloes-country	176	162	134	204
Buffaloes-Delhi	27	22	11	38

Prices:

Age.	Milk yield.	Prices from	to
1. *Cows-Ongole.*		Rs.	Rs.
1st and 2nd calving	2—3 Madras measures.	100	120
	3—4 ,, ,,	120	140
2nd and 3rd calving	2—3 ,, ,,	60	90
	3—4 ,, ,,	90	100
2. *Buffaloes-country.*			
1st and 2nd calving	2—3 ,, ,,	70	100
	3—4 ,, ,,	100	120
2nd and 3rd calving	2—3 ,, ,,	55	70
	3—4 ,, ,,	70	80
3. *Others.*			
Buffaloes-Delhi		150	200

1 Madras measure = 4 lbs.

Correspondence.

To

The Editor, Madras Agricultural Journal.

Sir,

The use of cinema films for Agricultural propaganda.

The Government are spending much on motor exhibition vans of the Health, Veterinary and Agricultural departments. When the vans are on tour, there is the expenditure of (1) pay and travelling allowances of the driver and the messenger (2) tax on permits (3) cleaning and repairing charges (4) petrol and

lubricating oils (5) wear and tear etc. Moreover the tour programmes of these vans cannot always be adhered to owing to some trouble or other. I suggest the following alternative to propaganda by travelling vans.

At the present day for every 10 miles or thereabouts there are one or two touring cinemas and in some villages the Government have installed radio sets. Is it not possible for Government to show departmental propaganda films in these cinemas?

The officers of all these departments who are already provided with magic lanterns, can continue to hold lantern lectures and shows in interior villages. By abolishing these motor exhibition vans, the Government can save a few thousands of rupees and this amount can be utilised for 'shooting' suitable subjects for propaganda.

Chandragiri, 26—7—1939.

Yours &c.,
C. Kesaviah Naidu.

To
The Editor, Madras Agricultural Journal.

Sir,

Indian Science Congress—Madras Session.

The twenty-seventh annual meeting of the Indian Science Congress will be held in Madras from the 2nd to the 8th January 1940. Members of the Madras Agricultural Students' Union, Officers of the Agricultural Department and others interested in Agricultural Sciences are requested to contribute papers of scientific interest to be read during the session.

Papers submitted for reading at the session can only be submitted by Ordinary and Full session members or through Ordinary members. Papers are not admissible for reading at the session by any one who has not been enrolled as a member by the 15th September 1939. If any one proposes to read a paper it should be forwarded together with three copies of an abstract so as to reach the General Secretary mentioning the Section before which the paper is intended to be read. not later than 15th September 1939 for submission to the Sectional Committee. Abstracts should be typewritten and must not exceed 200 words. They should not include formulae or diagrams. No abstracts will be printed unless accompanied by the full paper at the time of submission. Not more than ten minutes will be allowed for the reading of any paper. All correspondence on the matter should be addressed to local Secretaries of the Indian Science Congress, Madras Session, University Research Laboratory, Chepauk, Madras.

There are three classes of session members :—

(a) Full session members—subscription Rs. 10 per session.
(b) Associate session members—subscription Rs. 5 per session.
(c) Student session members—subscription Rs. 2 per session.

Chepauk, Madras. 21st. August 1939.

Yours &c.,
K. T. Alwa,
Secretary, Agricultural Section.

Crop and Trade Reports.

Statistics—Crop Sugarcane—1939—First report. The average of the areas under sugarcane in the Madras province during the five years ending 1937-38 has represented 2·8 per cent. of the total area under sugarcane in India.

The area under sugarcane up to 25th July 1939 is estimated at 102, 910 acres. When compared with the area of 75,720 acres estimated for the corresponding period of last year, it reveals an increase of 35·9 per cent. The increase in area occurs in most districts and is due to the recent high price of jaggery.

The condition of the crop is generally satisfactory except in South Arcot where it was damaged by the shoot borers to some extent.

The wholesale price of jaggery per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 9th August 1939 was Rs. 9-14-0 in Adoni, Rs. 7—9—0 in Rajahmundry, Rs. 7—7—0 in Mangalore, Rs. 7—6—0 in Cocanada, Rs. 7—5—0 in Vizagapatam, Rs. 7—4—0 in Salem, Rs 7-3-0 in Chittoor, Rs. 6—15—0 in Vellore, Rs. 6—12—0 in Cuddalore, Rs 6—10—0 in Vizianagaram, Rs. 6—7—0 in Erode, Rs. 6—6—0 in Bellary and Rs. 6-0-0 in Trichinopoly. When compared with the prices published in the forecast report issued at this time last year, these prices reveal a rise of 83 per cent. in Cuddalore, 62 per cent in Bellary, 56 per cent. in Adoni, 48 per cent. in Vizagapatam, 47 per cent. in Salem, 38 per cent, in Vizianagaram, 36 per cent. in Cocanada, 26 per cent. in Rajahmundry, 24 per cent. in Erode, 13 per cent. in Trichinopoly, 8 per cent. in Vellore, 5 per cent. in Chittoor and 1 per cent. in Mangalore.

Statistics—Gingelly—1939-40—First forecast report. The average of the areas under gingelly in the Madras Province during the five years ending 1937—1938 has represented 15·6 per cent. of the total area under gingelly in India.

The area under gingelly up to 25th July 1939 is estimated at 366,100 acres. When compared with the area of 338,900 acres estimated for the corresponding period of last year, it reveals an increase of 8·0 per cent. There has been a large increase in area in Chingleput, South Arcot, North Arcot, Salem and Coimbatore, which has been partly counterbalanced by a large decrease in area in Vizagapatam, East Godavari and West Godavari.

Yield. The yield is expected to be below normal in Vizagapatam, Chingleput, North Arcot, Coimbatore and Trichinopoly.

The wholesale price of gingelly per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 7th August 1939 was Rs. 6-8-0 in Cocanada, Rs. 6—6—0 in Rajahmundry, Rs. 6—4—0 in Tinnevelly, Rs. 6—0—0 in Vizianagaram and Tuticorin. Rs. 5—15—0 in Ellore, Rs. 5—14—0 in Vizagapatam, Rs. 5—11—0 in Cuddalore, Rs. 5—7—0 in Trichinopoly and Rs. 4—8—0 in Salem. When compared with the prices published in the report for the corresponding period of the previous year, i. e., those which prevailed on 8th August 1938, these prices reveal a rise of approximately 21 per cent. in Vizagapatam, 17 per cent. in Vizianagaram, 16 per cent. in Tinnevelly, 14 per cent. in Ellore, 13 per cent. in Cocanada, 12 per cent. in Rajahmundry and 5 per cent. in Tuticorin and a fall of 29 per cent. in Salem and 16 per cent. in Trichinopoly, the price remaining stationary in Cuddalore.

Statistics—Groundnut—1939—Second report. *Summer crop—Area and Yield.* The area under the summer or irrigated crop of groundnut in parts of the Madras Province during the five months—January to May 1939—is estimated at 75,500 acres When compared with the area of 82,500 acres estimated for the corresponding period of last year, it reveals a decrease of 8·5 per cent. The crop has been harvested in most districts. The yield is expected to be normal only in Anantapur and Cuddapah and below normal in other districts on account of insufficient rains. The total yield is estimated at 57,600 tons of unshelled nuts as against, 72,500 tons estimated for the corresponding period of last year.

Early crop—Area and yield. The area under the early crop of groundnut (mostly unirrigated) up to 25th July 1938 in the districts of Salem and Coimbatore, is estimated at 142,000 acres. When compared with the area of 146,000 acres estimated for the corresponding period of last year, it reveals a decrease of 2·7 per cent. A normal crop is reported from Salem. The crop in Coimbatore has been affected by drought to some extent. The total yield is estimated at 66,200 tons of unshelled nuts as against 67,700 tons estimated for the corresponding period of last year.

The wholesale price of groundnut (shelled) per imperial maund of 82⅞ lb. (equivalent to 3,200 tolas) as reported from important markets on 7th August 1939 was Rs. 5—0—0 in Cuddalore, Rs. 4—9—0 in Vizagapatam, Rs. 4—8—0 in Vizianagaram, Rs. 4—4—0 in Guntur, Rs. 4—3—0 in Cuddapah and Vellore, Rs. 4—1—0 in Tadpatri, Rs. 4—0—0 in Nandyal, Rs 3—14—0 in Bellary and Hindupur and Rs. 3—12—0 in Adoni and Anantapur. When compared with the prices published in the last report, i. e., those which prevailed on 10th July 1939, these prices reveal a rise of 2 per cent. in Nandyal and Hindupur and a fall of 7 per cent. in Guntur, 4 per cent. in Vizagapatam, 3 per cent. in Adoni and 2 per cent. in Tadpatri, the prices remaining stationary in Vizianagaram, Bellary, Cuddapah, Cuddalore, Vellore and Anantapur. (*From the Director of Industries and Commerce*).

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 18th August 1939 amounted to 3,86,958 bales of 400 lb. lint as against an estimate of 388,900 bales of the total crop of 1938—39. The receipts in the corresponding period of the previous year were 3,91,590 bales. 3,04 151 bales mainly of pressed cotton were received at spinning mills and 1,62,290 bales were exported by sea while 1,17,407 bales were imported by sea mainly from Karachi, Bombay and Egypt.

(*From the Director of Agriculture*).

College News and Notes.

Students' Corner—*Students' Club. Welcome to freshers*—The students of the second and third year classes welcomed the students of the first year B. Sc. class and the short course, on the 26th July. The function began with tea and was followed by music. The Principal's speech welcoming the students to the college was followed by speeches from the lecturers, tutors and coaches. To the cordial welcome extended by the representatives of classes II and III, the representative of class I and short course made a suitable reply.

A Debate. A debate that in the opinion of the house "political reform should precede social reform" was held on the 7th instant in the Freeman hall with Mr. G. V. Chellappa, student president in the chair. Mr. Muhammad Sulaiman of class III spoke for the proposition and Mr. S. N. Ramasubramanian of class II led the opposition. Mr. R. C. Broadfoot was the observer. A large number of students and other members took part in the discussions and the proposition, when put to vote was carried by a large majority.

An address. At a meeting of the students' club held on the 15th instant in the Freeman hall, Mr. M. S. Sundareswaran, M. A., L. T., Headmaster of the Wardha Education School, Coimbatore, delivered an interesting and instructive address on "Wardha scheme of education" to a packed gathering of students, officers, residents of the estate and a number of ladies and women teachers of the local Government training school. Mr. Md Sulaiman, student presided. In a beautiful speech, which held the audience engaged for nearly two hours, the learned lecturer, pointed out, *inter alia*, the defects of the present system of education and explained the feasibility of introducing the Wardha scheme to suit the psychology of the child. On behalf of the students and other members of the gathering, a purse of Rs. 68—14—0 was presented to Mr. Sundareswaran towards the feeding and maintenance of the poor school children, at the Wardha school newly opened by the Government in the old Forest college buildings

Games. *Cricket.* The cricket season has begun. The activities of the college team are in full swing. In a match played on the 29th of July against the local Government college team, our team put up a total score of 144 (Padbhanabhan 5 for 50) against a total of 66 of the Govt. college (S. V. Srinivasan 5 for 25). A feature of this match was the century (109) scored by S. V. Srinivasan who incidentally made the maiden century of his career.

A friendly match was played on the 30th July between the Officers' XI and the Students XI. The Officers were all out for 193, (K. K. R. Menon 42, C. N. Babu 69, K. Sanjiva Shetty 22, Somanna 2 for 42, S. V. Srinivasan 2 for 52, Radakrishnan 2 for 30). The students were all out for 149 (M. R. M. Punja 73 which included 10 boundaries), K. M. Somanna 21, and Mohinuddin 33).

Rhondy Shield. The first of the match of the series was played on the 5th instant between the Agricultural college B team and the Govt. college, in which our team was defeated,—the score being Govt. college—218 all out (Padbhanabhan 44, Srikant 35, Natesan 36—Ayyappa 3 for 27, Mukundan 3 for 48). The Agrl. Coll. B. team scored 89 all out—M. R. M. Punja being the top scorer 32 not out (Padbhanabhan 5 for 26).

In the second match of this series the Agricultural college A team beat the S. R. C. A team by a big margin. The College A Team put in a total of 225 for 4 and declared before lunch. (C N. Babu 92, H. Shiva Rao 72 (retired) and K. K. R. Menon 43). The S. R. C. were all out for 89 (Narasimham 40, Hornby 19, S. V. Srinivasan 5 for 28 and Kodandaraman 4 for 34).

The Palghat 'Victoria College' came over to Coimbatore and played a friendly match with the Agricultural College on the 20th instant. The home team batting first were all out for 131 (S. V. Srinivasan 23, Mohinuddin 21. Sankar Rao 21, Madhavan 2 for 35). The visitors were dismissed for 76, (Madhavan 36, S. V. Srinivasan 4 for 24, Somanna 3 for 9 and Shankar Rau 2 for 11),

The Agricultural A and B teams, met in a fixture on the 12th instant, in which the former team won. The A team put up a total of 188 (K. K. R. Menon 42, S. V. Srinivasan 47, Ayyappa 3 for 16, Radhakrishnan 2 for 37. The B team gathered a total of 100 (Narayana Kamath 22, Shankar Rao 23 not out, S. V. Srinivasan 4 for 49, Kothandaraman 4 for 27).

Tennis. A fourth tennis court was opened by Mr. R. C. Broadfoot, Principal on the 1st instant. This has satisfied a longfelt need of the students' club. An exhibition match was played on the 2nd instant in which Messers C. Ramaswamy, M. V. Bobjee and Choudiah participated.

Football. The college eleven played the local Municipal High School on the 4th instant which ended in a draw of 3 goals all. In two fixtures against the officers' XI, the students won the first at 3--0 and lost the second 0—1.

Hockey. The College XI met the Students' Union Club, Coimbatore on the 28th July in a friendly match and lost by 2 goals to nil. The match against the police recruits school ended in a win for our team by 3 goals to nil. A match was played against the officers' XI on the 14th instant in which the students won by a narrow margin. In an exciting match played on the 17th instant against the Crescents XI, our team was defeated by one goal to nil.

Personal. We are glad to record that Mr. C. Ramaswamy who was on the staff of the agricultural college and is now Deputy Director of Agriculture, Coimbatore, has been chosen as one of the three members (Selection Board) for the selection of the All India cricket XI against the English team touring India during the next cold weather. We offer our felicitations to him on this recognition.

Officers' club. In the World Bridge Olympic championship for 1939 held in April last, Messrs. M. S. Kylasam and T. S. Ramasubramanian of the Agricultural College Officers' Club have been declared to be the winners among the North-South pair for the whole of India and have thus won a most coveted bridge trophy. We heartily congratulate the winners on this great distinction.

M. Sc. Degree. The degree of M. Sc. has been conferred on Mr. T. Venkataramana Reddy, B. Sc. Ag., Assistant in Millets by the Madras University for his thesis on "Genetic studies in the seedling colours of sorghum". We congratulate Mr. Reddy on his success.

Ladies' Club. The building of the Agricultural College Ladies' Club which has been a place of recreation for the ladies of the estate during the last 12 years has been recently electrified. The Hon. Mr. V. I. Muniswamy Pillai, Minister for Agriculture switched on the lights on the 31st of July before an imposing gathering of ladies and gentlemen of the estate. The energetic secretary of the Ladies' Club, Mrs J. David deserves to be specially congratulated for expediting the electrification of the club building.

Visitors. Messrs R. W. Littlewood and Kerr were here during the second week of the month for the purpose of inspecting the Dairy cattle of the central farm.

Weather Review—JULY 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st	Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	6·5	−0·4	12·6	South	Negapatam	0·3	−1·6	18·3
	Calingapatam	5·6	+0·3	11·3		Aduthurai *	0·0	−1·3	16·4
	Vizagapatam	5·1	+0·6	9·9		Madura	0·0	−1·9	14·8
	Anakapalli*	4·2	−0·9	8·2		Pamban	0·0	−0·6	8·3
	Samalkota*					Koilpatti*	0·0	0·0	0·0
	Maruteru*	6·3	−1·2	8·9		Palamkottah	0·0	−1·1	5·0
	Cocanada	5·2	−0·6	11·9					
	Masulipatam	4·0	−2·4	8·6					
	Guntur*	4·8	−1·1	7·9	West	Trivandrum	8·0	+0·6	36·1
					Coast	Cochin	22·3	−0·5	85·5
Ceded	Kurnool	2·3	−2·5	5·0		Calicut	34·3	+4·2	78·0
Dists.	Nandyal*	0·0	0·0	0·0		Pattambi *	28·5	+2·9	61·5
	Hagari *	2·1	+0·3	4·7		Taliparamba *	45·92	+1·0	84·7
	Siruguppa*	3·1	0·0	4·5		Kasargode *	35·6	−6·7	80·5
	Bellary	1·2	−0·6	4·3		Nileshwar*	39·4	−3·1	71·9
	Anantapur	0·7	−2·7	6·6		Mangalore	37·3	+0·2	79·5
	Rentachintala	4·3	...	7·7					
	Cuddapah	2·0	−1·9	6·1					
	Anantharaju-				Mysore	Chitaldrug	3·4	+0·3	11·9
	pet*	2·5	−2·5	10·3	and	Bangalore	2·4	−2·0	14·8
Carnatic	Nellore	2·6	−0·2	6·9	Coorg	Mysore	1·0	−1·6	11·6
	Madras	1·4	−2·5	8·6		Mercara	37·0	−9·9	52·8
	Palur*	0·8	−1·9	13·8					
	Tindivanam *	0·7	−1·1	10·0	Hills	Kodaikanal	1·5	−3·5	21·5
	Cuddalore	0·7	−2·4	16·9		Coonoor			
Central	Vellore	1·7	−3·6	11·8		Ootacamund *	6·0	+0·1	21·4
	Salem	2·3	−1·5	17·5		Nanjanad *	7·9	−2·9	19·2
	Coimbatore	0·9	−0·6	5·8					
	Coimbatore A. C. & R. I.*	1·3	0·0	5·7					
	Trichinopoly	0·1	−1·5	14·6					

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette.

The monsoon was active during the month. It caused general rain in the Konkan, Malabar, Mysore, Bombay, Deccan and N. Hyderabad ; and local showers in the Madras Deccan, South Hyderabad and North Madras Coast.

Four depressions of the Bay of Bengal were responsible for wide-spread rainfall. Skies were moderately to heavily clouded along the west coast, Bombay,

Deccan, Mysore and North Hyderabad and lightly to moderately clouded elsewhere. Humidity was in excess in all places except the extreme south of the peninsula where it was normal and in South East Madras where it was in defect. Maximum temperatures were below normal in the Konkan, Mysore, South East Madras, Madras Deccan and North Madras Coast. The highest maximum recorded was 101°F on the 29th at Madura, Trichy and Nellore.

The rainfall however was in defect generally except in parts of the West Coast.

The chief falls of rain were :—

Pattambi	...	3·3″
Nileshwar	...	3·6″
Mangalore	...	4·4″ on the 13th.
Calicut	...	4·5″ on the 15th.
Taliparamba	...	5·3″.

Weather Report for Agricultural College and Research Institute Observatory:

Report No. 7/39.

Absolute maximum in shade	...	91·0°F.
Absolute minimum in shade	...	70·0°F.
Mean maximum in shade	...	86·3°F.
Departure from normal	...	−0·8°F.
Mean minimum in shade	...	72·7°F.
Departure from normal	...	+0·7°F.
Total rainfall for the month	...	1·3″
Departure from normal	...	nil.
Heaviest fall in 24 hours	...	0·7″ on the 15th.
Number of rainy days	...	3
Mean daily wind velocity	...	7·8 m. p. h.
Departure from normal	...	+0·8 m. p. h.
Mean humidity at 8 hours	...	67·1%
Departure from normal	...	−6·9%

Summary. The monsoon was active during the month, and 1·3 inches of rain were received of which 0·7 inch was received on the 15th. The rainfall was just normal Skies were moderately to heavily clouded and the humidity was in defect. The mean maximum was slightly below normal and the mean minimum was slightly above normal.

P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notifications.

1. Appointments.

Sri. R. N. K. Sundaram, Assistant Director of Agriculture, Nellore is appointed to officiate as Deputy Director of Agriculture in Category 4 Class I, Madras Agricultural Service and is posted to III Circle, Trichinopoly *vice* Sri Y. G. Krishna Rao Nayudu transferred.

Sri. L. Narasimha Acharya, Agricultural Demonstrator, Chittoor is appointed to officiate as Assistant Director of Agriculture in Category 6-Class I Madras Agricultural Service and is posted to Nellore vice Sri. R. N. K Sundaram on other duty.

Sri R. Balasubrahmanya Ayyar, Assistant, Cotton Section, Guntur is appointed to officiate as Gazetted Assistant Mungari Cotton Breeding Station, Adoni in Category 8-Class I Madras Agricultural Service—with effect from the afternoon of 6th July 1939 vice Sri. V. K. Subrahmanya Mudaliar granted leave,

2. Transfers.

Name of officers.	From	To
Sri. Y. G. Krishna Rao Nayudu.	Offg. Dy. D. A., III Circle, Trichinopoly.	Offg. Dy. D. A., I Circle, Cocanada.

3. Leave.

Name of officers.	Period of leave.
Sri. A. Chinnathambi Pillai, Offg. Asst., D. A., Madura.	L. a p. for 2 months and 15 days from 17–6–39
, B. Ramiah, Dy. D. A., I Circle, Cocanada.	L a. p. for four months from the date of relief.
,, A. Ramaswami Ayyar, Offg. Supdt., A R. S. Anakapalle.	L. a. p. for two months from date of relief.

Subordinates Services.

1. Appointments.

Sri. D. Viswanatha Reddi, M. A., (Madras), B. Sc. in Agriculture (Edin) is appointed as Upper subordinate, Agricultural section I Grade-on probation on Rs 145 in the new revised scale of Rs. 145—15/2—190 in an existing permanent vacancy from 1st August 1939 and is posted to Central farm, Coimbatore.

Mr. Herbert A. Adiseshaiah, B. Sc. Ag. is appointed to officiate as upper Subordinate, Agricultural section, III grade on Rs. 75 in the new revised scale of pay on Rs. 75—7½/2—105 in Category I Class I, Madras Agricultural Subordinate service, Vice Sri. M. Subbaiah Pillai on other duty, and is posted to IV Circle, for work in the Tirupattur division.

Sri. P. K. Natesa Ayyar, B. A. B. Sc. Ag. Farm Manager, Central farm, on Rs. 120 in the old scale of Rs. 85—5-120 is appointed to the post of Agricultural Demonstrator in the new III grade temporarily for a period of 9 months from 10th July 1939 for work in the new School opened at Coimbatore for training of teachers in the Wardha Scheme of Education,

2. Transfers.

Name of officers.	From	To
Janab K. Soopi Haji Sahib,	Asst, A. D., Badagara	Off. Asst., F. M., Sim's Park, Coonoor,
Sri E. Achyutan Nayar,	Asst. A. D., Kallakuruchi	Asst. A, D., Badagara.
,, K. L. Ramakrishna Rao,	Cotton Asst. (on leave)	A. D., Ponneri.
,, C. Vadamalai,	A. D., Hindupur (on leave)	A. D., Vayalpad.
,, V. Kumaraswami,	A. D., Vayalpad	F. M. A. R. S., Nandyal.
,, S. Bhima Raju,	A. D. (on leave)	A. D., Chandragiri.
,, S. Muthuswami Iyer,	A. D. (on leave)	A. D., Madurantakam.
,, S. Krishna Naik,	A. D., Mangalore	A. D., Kasargode.
,, K. G. S. Bhandari,	A. D., Tirupur	A. D., Mangalore.
,, M. Subramania Pillai,	A. D., Erode	A, D, Tirupur.
,, K. Ramaswami Iyer,	A. D. (on leave)	A. D., Erode.

„ M. A. Balakrishna Ayyar,	A. D., Vellore	A. D., Wallajah.
„ M. Alagiriswami,	Asst. A. D., Wallajah	A. D., Tiruvannamalai.
„ K. E. Viswam Ayyar,	Asst. A. D., Tiruvannamalai	A. D., Wandiwash.
„ M. Obaidullah Shah,	A. D., Wandiwash	A. D., Vellore.
„ A Subba Rao,	A. D., Siruguppa	Sugarcane Growers' Co-operative Union, Hospet.
„ A. R. Krishnamurthy,	Asst. A. D., Orthanad	A. A, D., Karur.
„ K. S. Kuttimudali,	A. D., under training, Devakottah	A. D., Othanad.
„ K. Krishnan,	Livestock section	A. D., Cheyyar,
Janab Mohammad Abbas Sahib,	A. D., Cheyyar	A. D., Gudiyatam.
„ S. Khadir Rasack Sahib,	A. D., under training, Proddatur	A. D., Koilkuntla.
„ Shaik Hussain Sahib,	A. D., under training, Cuddapah	A. D., Atmakur.
Sri P. Ramanadha Rao,	A. D , Atmakur	A. D., Masulipatam.
„ P. Sudarsanam Nayudu,	A. D., Masulipatam	Madanapalle.
„ D. Shanmugasundaram,	A D., Periyakulam	A. D., Aruppukottai.
„ T. V. Ayyaswami Ayyar,	Asst. A. D., Aruppukottai	A. D., Ariyalur.
„ Annaswami Ayyar,	A. D. (on leave)	A. D., Giddalore.
„ C. Annamalai,	A. D , Madanapalle	A. D., Tiruttanni.
Janab Muhamad Obaidulla Shah,	A. D., Wandiwash	A. D., Periakulam.
„ Shaik Hussain Saheb,	A. D., undergoing at dist. work at Cuddapah	A. D., Pathikonda.
Sri B. Ramakrishna Reddy,	A. D., Pathikonda	A. D., Atmakur

Leave.

Name of officers.	Period of leave.
Sri V. G. Venkataramana Rao, A. D., (on leave)	Extension of earned leave for 1 month and 15 days from 1—7—39.
„ D. Hanumantha Rao, A. D., (on leave)	Extension of leave a. p. on m. c. for 15 days from 9--7—39.
„ S. Bhima Raju, A. D., (on leave)	Extension of l. a. p. for 14 days on m. c. 18—7—39.
„ S. P. Fernando, Asst. A. D., Harur	Extension of l. a. p. for 3 weeks from from 22--7—39.
„ K. Govindan Nambiar, F. M., Taliparamba	L. a. p. for 4 months from 17—7—39.
„ P. Gopalakrishnan, F. M., A. R. S., Koilpatti	Leave on half average pay for 1 month on m. c. from 6—7—39.
„ K. S. Ramana Rai, A. D., Moodbidri	L. a. p. for 15 days from 2—8—39.
„ R. Govindaramayya, A. D., (on leave)	Extension of l. a. p. for 15 days from 6-8—39.
„ N. Parthasarathi, Asst. in Paddy. Coimbatore	L. a. p. for 15 days from 4—8—39.
„ T. Varahalu, Asst. in Chemistry	L. a. p. for 15 days from 31—7—39.
„ Y. Venkataswami Rao, Asst. A. D., Bapatla	L. a. p. for 1 month from 1—8—39.
„ M. K. Gopalan, A. D., Proddatur	Extension of l. a. p. for 13 days from 8--7—39.

„ K. V. Seshagiri Rao, Asst. A. D., Atmakur	Extension of l. a. p. on m. c. for 2 months from 8—7—39.
„ E. K. Govindan Nambiar, F. M., Taliparamba	L. a. p. for 15 days on m. c. from 3—8—39.
„ C. Jagannatha Rao, Asst in Cotton, A. R. S., Nandyal	L. a. p. for 1 month and 2 days from 1—8—39.
„ R. Alagiamanavalan, A. D., Punganur	L. a. p. for 1 month from 3—8—39.
„ C. S. Balasubrahmanyam, Asst. in Entomology (on leave)	Extension of L. a. p. for 14 days from 28 -7—39.
„ C. Ranganatha Swami, F. M, A. R. S., Anakapalli	L. a. p. on m. c. for 3 months from 26—7—39.
„ T. S. Dakshinamurthi, A D., Adoni	L. a. p. for 1 month from 8—8—39.
„ C. S. Gopalaswami Rao, Asst. in Mycology undergoing training in Entomology	L a. p. for 4 months from the date of relief.
„ R. Krishnamurthy, Cotton Asst., A. R. S., Nandyal	L. a. p. for 2 months from 12—8—39.
„ M. V. Narasimha Sastri, Asst. A. D., Nandigama	L. a. p. for 4 months from 15—8—39.
„ T. Varahalu, Asst. in Chemistry, Coimbatore	Extension of l. a. p. for 15 days from 15—8—39.
„ Shivashanker Rao Gangolly, Taxonomical Asst. Fr. R. S., Kodur	Extension of l. a. p. for 19 days from 13- 8—39.
„ C. S. Balasubrahmanyam, Asst. Entomology, Cuddapah	Extension of l. a. p. for 1 week from 11—7—39.
„ N. Annaswami, A. D, (on leave)	Extension of l. a. p. for 1 month from 25—8--39.
„ P. Ramanadha Rao, A. D., Atmakur	Earned leave for 15 days from 17-8-39.
„ M. S. Subbiah, Asst. in Entomology, Tinnevelly	L. a. p. for 2 months from 10-8-39.
„ K. Venkataswami, A. D., Palladam	L. a. p. for 1 month from 23-8-39.
„ K. M. Krishna Menon, Offg Asst. in Chemistry	L. a. p. for 1 month from 21-8-39.

Agricultural College and Research Institute, Coimbatore.

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The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

Vol. XXVII.] SEPTEMBER 1939 [No. 9.

EDITORIAL

The War. When the Great War ended in 1918 and armistice was signed, the saner section of the worlds' population believed that the last of the great wars in human history was fought once for all. The reclamation of devastated areas and the recovery of agriculture, industry and commerce took several years to attain the pre-war level. Indeed, the world has not, as yet recovered from the economic debacle which followed the great war. Despite this handicap, the last two decades have witnessed rapid strides in the sphere of science and industry in a manner never known before. Scientific progress has revolutionised human knowledge and has added greatly to the happiness of mankind in an imperfect world. When the world was thus slowly finding its level and returning to a state of prosperity, alas! greed and self-elation which has been brewing in the heart of Europe has suddenly seized the world again. The dogs of war have once again been let loose on peace-loving populations. The result is that precious human lives are being sacrificed, trade paralysed, peaceful industries brought to a stand still or diverted to the creation of weapons of destruction: agricultural commodities are cornered, the agricultural and industrial populations weaned from their peaceful avocations to fight against the whims of a dictator. The world has once again gone back to a state of tension and anxiety about the future.

Britain's unselfish choice to enter the arena in the defence of weaker nations in their struggle against aggression and domination by brute force deserves the warmest support of right thinking men the world over. We feel sure that in this crisis, India will, as she did in the past, stand by Britain and play her noble role in the creation of a new world order in which swords will again be beaten into plough-shares and tanks converted into tractors.

Agricultural Extension Work in America.

By J. J. De VALOIS, B. Sc.,
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History. Cooperative demonstration work radiating out from the Federal U. S. Department of Agriculture, Washington D. C. and in cooperation with the Agricultural Colleges in the 48 States of the Union, is this year celebrating its 25th anniversary in America. May I just briefly outline some of its aims and ideals in the hope that it may raise some thought as to whether an organization something similar in nature may not have possibilities for India too. This great movement in America arose in direct response to a real emergency in the rural life of the South where the cotton boll-weevil was threatening the very existence of the farmers in that area. Dr. Seaman A Knapp, recognized as the founder of this great movement as well as the pioneer president of the Iowa State College, one of the leading colleges of agriculture in America, realized that the farmers and their wives and children had to be an organized body if they were effectively to meet the problems affecting their general welfare. In 1914, the U. S. Congress through the Smith-Lever Act, permanently appropriated funds for use in cooperation with the state colleges of agriculture, in giving instruction and practical demonstration in the best methods of farming and home-making to people on the farm.

Organisation. When this movement celebrated its 25th anniversary this year, it was reported that there were 4,121 country agricultural agents and assistants ; 2,142 home demonstration agents and 1,516 specialists engaged in this extension service to the rural population of America. Together with this staff paid from federal, state and local funds, is a small army of honorary, local leaders working under the guidance and instruction of these specialists and experts. These honorary leaders are really the backbone of the whole movement. At Washington D. C., in the department of agriculture represented in the U. S. President's cabinet, are numbers of specialists working in various departments guiding and directing the work of the 48 independent states. In each of the states, associated usually with the state college of agriculture, is the state extension service, comprising graduates in agriculture and home economics, specialists who again in turn go out on special programme as arranged by the leaders in the local counties and similar experts called county agricultural agents, home demonstration agents and boy and girl club leaders. A county would roughly correspond with a taluq in the Madras presidency. These county agents receive usually about half their salary from the State and Federal Government and half from local subscriptions and membership.

In addition to these are the rural consolidated high schools, with their departments of agriculture and home making, working more specifically with the boys and girls of high school age but also carrying on programmes of

work with the adults in the smaller community and in cooperation with their county agents in agriculture, home economics and club work. The Future Farmer clubs are specifically organized clubs for boys and girls who are taking recognized work in vocational agriculture and home-making with the intention of remaining in the rural area for work on their own farms and homes after graduation from high school. I got a great thrill attending the annual meeting of this fine organization at Kansas City, Missouri last year. More than 3,000 boys and girls attended this three day function.

The 4H club is a distinctive youth organization under the Extension department working with rural children ranging in age from 10 to 20 years emphasizing *head, heart, hand, health*, in their programme of work. The organization promotes the development of each of these vital activities in a young person's life. On the 25th anniversary of the organization, there were 1,286,029 members enrolled and approximately 7,500,000 boys and girls, young men and women in America who had received 4H club training since 1914. More than forty per cent of rural boys and girls old enough to enroll are today members of this great, nation-wide youth movement. I think you can see that they have done a great deal to revolutionize American rural life. I was tremendously impressed with this fact when we went around in the great rural areas of our country last year. This organization that emphasizes the training of the heart, head, hand and health, fits rural boys and girls in making the country a better place to live in. Better crops more efficient farms, nicer farm homes, and more attractive and healthful ones, more social activities and better recreation for the community as well as better fed boys and girls are some of its aims.

I was interested in attending an open forum discussion of some independant, local 4H club leaders when the topic for discussion was that of trying to evaluate the benefits they had received from club work. They listed such as the following :—

1. Self-reliance-knowing how to do a thing and being able to proceed without hesitancy or embarrassment.
2. Friendships-contacts and the ability to meet and mix with other people.
3. Better ability to perform everyday household-tasks in a practical and efficient manner.
4. Appreciation and desire for a nice, well-ordered home and ability to utilize products at hand to manage their families on an economical basis and within the range of their incomes.
5. Standardization and improvement of all classes of live-stock, better feeding and marketing, record keeping, formation of co-operative associations, and economical production of all classes of crops suitable to the area.
6. Appreciation of the value of social and religious organizations such as the church, the farm bureau, the consolidated school and their responsibility to further their respective interests.

The Extension depaıtment recognized that adult farmers could be persuaded to change their practices only with difficulty while boys and girls are more easily influenced to try new and improved methods and thus offer a fertile field for progress. Many thousands of these boys and girls do not have the opportunity of an education beyond that of the 8th standard, which is the lowest unit recognized in America, or possibly that of the High School or College, but through such club work, all can be partially trained to better fit them for rural life and living.

A Comparison with conditions in India. What is the situation in India along these lines? We have the Imperial Council of Agricultural Research with its interest in the development of agriculture on a national basis. Many of the provinces have excellent colleges of Agriculture with their affiliated research work often carried out in other centres in addition to the one connected with the main station at the college. In our Madras province we have the agricultural demonstrator at work in an area quite comparable to the County in America. Unfortunately, none of the American work for women is as yet organized in India in the same way as it is in agriculture for the men. Nor is anything of a similar organization found for the boys and girls, the youth of the nation and as such possibly the most responsive and the most important. Nor do we find the organization of the honorary non-official, local leader whom I have tried to describe as the backbone of the whole extension movement in America. Would not the work of the agricultural demonstrator be greatly heartened and made a hundred times more fruitful, if he would use more of his time in the training of such local leaders who would demonstrate effectively improved methods of agriculture and development? Alongside of it we should see the development of work among the women and even more urgent, that among the boys and girls and the youth in our villages. They after all are the hope of future India.

What the missions can do? What are we doing for such activities in our local Missions? To what extent are we reaching the thousands of young men and young women, boys and girls who will never have the opportunity of our Mission boarding schools? Are they not a sadly neglected group? Can we not organise clubs or groups, or Y. M. C. A's or youth organizations of some kind, call them what we will, to work along with the activities of the Church in the improvement of their homes, their ommunities, their family life, their social contacts, their income from the soil and cottage industries.

Research in Irrigation.*

By S. KRISHNAMURTHI, B. Sc. (Ag.).
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Introduction. Agriculture under irrigation plays a prominent part in the rural economy of this country and the consideration of its problems is of primary importance. The irrigation farmer offers the greatest scope for scientific and practical improvements and is thus of particular interest to the agricultural department. He can afford to do what the dry-land farmer generally cannot.

Except perhaps in the West Coast of this Presidency, there is no absolute security of harvest without some form of irrigation. For this reason, large areas are protected by irrigation works. Besides the protection afforded, irrigation increases the yield of crops and thus multiplies wealth.

The following figures reveal the importance of irrigated agriculture in this presidency. Of the 32 million acres cultivated, 9 million acres are under irrigation. The figures of 1937—38 show that the irrigated area is actually 27·3% of the total cultivated area. Up to 1935—36, the total capital outlay of the irrigation works was 1,521 lakhs and accumulated surplus returns 3,243 lakhs. The returns have thus doubled the outlay. The gross receipts for the year were 164 lakhs and the percentage of net return on capital outlay was 7·44 (8 & 9).

Present sources of irrigation. The ryot depends for water supply on three main sources, rivers, tanks and wells. As classified by the Irrigation Department, the following were the areas irrigated in 1937—38.

No.	Sources of irrigation.	Area in thousands of acres.
1.	Government canals	3,750
2.	Private channels	163
3.	Tanks	3,192
4.	Wells having indep dent ayacuts	1,359
5	Wells supplementing recognised sources of irrigation	255
6.	Other sources, i. e. spring channels etc.	281

As can be seen from these figures, the canals and tanks are of the greatest and almost equal importance while in other provinces, tanks are not so important as the canals. The tanks are as many as 35,000 in number. Next in importance are the wells which are 700,000 in number.

The great irrigation systems of this presidency are the deltaic ones of the Godavari, the Kistna and the Cauvery. By these, some 2·4 million acres of fertile deltaic lands enjoy the benefits of an assured supply of water. Examples of the great storage reservoirs in this province are the Periyar and the Cauvery-Mettur systems. The Mettur dam is expected to improve the existing supply for an area of 1·04 million acres and to bring in a new area of 0·3 million.

* Paper read at the M. A. S. U. Conference, July 1939.

The Maintenance of the present water supply. The first need for irrigated agriculture to thrive as an industry, is an assured supply of water, from the already existing sources of irrigation. This aspect is well looked after by the Irrigation Department. Fortunately the deltaic systems above mentioned, unlike in other provinces, do not present much of a difficulty in regulating the water supply.

But the maintenance of as many as 35,000 tanks and in some cases their restoration, present a problem which has been taxing the department concerned. It is a duty which the Government owes to the ryots, especially to the smaller cultivators, to keep these tanks in good repair, since over wide areas, the only source of irrigation is the conserved annual rainfall. The Irrigation Department has been quite alive to this aspect and the formation of an improved organisation to give particular attention to this aspect has been for a long time the concern of this department. Opinion is held that the gradual expansion of the system of Irrigation Panchayats for the management of Minor Irrigation works will not only give the Irrigation Department more scope for attention to the major works but will also prove beneficial in the long run to the cultivators themselves.

The maintenance of the existing wells is a matter that can be left to the cultivator, for he is himself immediately concerned with it and is bound to give his utmost attention to it.

Possibilities of expansion of irrigation sources. We now come to the problem of extending the sources of irrigation. Regarding the major works, this is one of great importance: because, firstly, the existing supplies are often insufficient to irrigate all the area under irrigation even for the first crop and additional supplies are needed for the cultivation of second crops which are now grown, if at all as 'dry'; secondly, protection is needed for those tracts where the threat of famine and drought is ever present viz. districts of Bellary, Cuddapah, Kurnool and Anantapur, and some parts of Coimbatore. The Tungabhadra and Bhavani projects are meant to protect these areas to a large extent and the Government have shown their utmost anxiety to complete these projects. The possibilities of extending the minor irrigation works wherever possible, which are of so much importance in this presidency, have always been under consideration.

We have next to consider the problem of extending well irrigation. The development of this source in the Madras Presidency has been one of greatest importance. In 1935—36, the total number of wells in Madras was 6,75,438 of which three districts, viz, North Arcot, Coimbatore and Trichinopoly contributed the largest numbers being in order, 1,18,933; 97,810 and 62,131. This development has been mainly due to the liberal policy of Government in exempting private improvements from additional taxation[7] Technical advice and assistance have always been forthcoming from the departments of Government. There is still scope for expansion in the number of wells, especially in the areas which do not have the benefit of

canal irrigation. The success of a well as a paying proposition, depends on the depth at which the subsoil water can be tapped and on the agricultural possibilities of the land to be irrigated. On these matters and on the best and cheapest methods of lifting water, the cultivator needs advice from the agricultural engineers and the agricultural department.

There is one other source of water supply which has possibilities of expansion i. e., irrigation from small streams by means of power-driven pumps placed on banks or temporary floats. This source can protect harvest over thousands of acres. The Agricultural Engineering Section is in the best position to devise cheap and efficient pumps with suitable platforms, combining low lift with high discharging capacity.

Need for irrigation research. There will soon come a time when the possibilities of constructing large irrigation works will come to an end and few new sources will remain to be exploited. When it does come, the chief problem will be (1) to make the available water go a longer way than it does now or in other words, the economic use of water and (2) to improve the irrigated areas so as to obtain better yields and better profits or in other words, land improvement.

The problem mentioned above will resolve itself into two broad lines, necessitating research :—

1. Lessening wastage of water.

2. Remedying defects that have become characteristic of irrigated lands, viz., water-logging and alkali problems.

Lessening wastage of water There are two ways by which this can be effected. One is decreasing the loss due to seepage in canals and another, economy in use of water.

Loss by seepage. This problem of loss of water by seepage from canals is one which has been engaging the attention of irrigation engineers for a number of years. It is a serious one ; because firstly, all the water lost is valuable water which could extend the area of irrigation, and secondly, it induces conditions of water-logging and concentration of salts, which are dealt with later. The seriousness of this factor of loss through seepage can be imagined when it is stated that the investigations made on irrigational canals in India have shown that in certain cases, the losses due to evaporation and seepage amounted to more than one half of the entire supply. The Punjab Irrigation Research Institute has been doing valuable work and experiments there have indicated that in certain specified cases, of common occurrence, seepage can be greatly reduced by treating the bed of the canal with sodium carbonate[4]. This method which does not involve high costs is under trial in other provinces.

Economy in use of water. It is universally admitted that there is enormous waste of water by cultivators in the canal irrigated tracts. In this connection, it has been a rule to contrast this with the sense of economy which the ryot employs when it is his well from which he irrigates his crops.

There are two main reasons as to why the cultivator does not economise the water from the canals :—

1. The assessment is by area and not by volume of water used.

2. There is the uncertainty of supply. He is unable to know at what intervals he will get his turns for water. Hence he attempts to make the best of it when he gets his turn.

The result is, there is wastage of water that could be profitably used otherwise. Assessment by area has therefore the fundamental defect that it offers no incentive to the cultivator to economise in the use of water. The ultimate aim should therefore be, to charge the cultivator by measurement of water he consumes for his crops. This aspect is one that has to be worked out by Irrigation Engineers and it involves several mechanical and administrative difficulties.

Distributaries in the Punjab have been fitted with meters functioning with modules, fixing the proportion of water taken from the canal and giving an even distribution from the head to the tail.[6]

However, as it stands now, the wastage of valuable water is not the only thing that matters: there is also definite damage to the soil. It is to this aspect that attention has to be directed even more particularly and the ryots have to be warned of the nature of damage. Over-irrigation and wasteful application of water produce harmful effects in several ways :—

1. Due to lack of aeration of roots, the ultimate yield of crop is lessened.

2. The soil gets impoverished through leaching and it deteriorates.

3. It spoils the climate, rendering it too humid and malarious. (1, 2 & 3).

For these reasons and to get the utmost benefit from water, either of the private well or of the public works, the cultivator must know the 'economic duty' for the crops he wants to raise.

Research in Madras To this end in view, the Agricultural Department after having been consulted by the Irrigation Department, commenced in 1932—33, investigations on duties of water on a variety of crops viz. paddy, sugarcane, cholam, ragi and cambodia cotton. At first the work was to record the "gross duty' of water for each crop. The record up to 1938 on the Central Farm [12] showed that the figures varied from season to season and two figures were not often alike as is evidenced by the statement below (Table 1).

In 1937, a more elaborate and more useful plan was drawn up, to conduct definite experiments, introducing variations to cover the following:—

(a) Cultural treatment and depth of each watering to be kept constant but intervals between waterings to be varied.

(b) Cultural treatment and interval between waterings to be kept constant but depths of individual waterings to be varied.

TABLE I. Irrigation experiments on the Central Farm, Coimbatore.

Statement of water consumption of crops.

Year	Ragi.			Cambodia Cotton.			Chitrai Cholam.		
	Quantity of irrigation water in acre inches	Quantity of rainfall during crop period in acre inches.	Total quantity of water in acre inches.	Quantity of irrigation water in acre inches.	Quantity of rainfall during crop period.	Total quantity of water in acre inches.	Quantity of irrigation water in acre inches.	Quantity of rainfall during crop period in acre inches.	Total quantity of water in acre inches.
1933				8·69	19·02	27·71	5·0	8·21	13·21
1934	23·87	1·59	25·46	8·19	12·31	20·50	13·78	7·99	21·77
1935	14·76	3·24	17·60	9·99	12·64	22·63	17·83	4·03	21·86
1936	15·40	5·44	20·57	12·97	10·98	23·95	14·13	4·60	18·73
1937	18·30	5·25	23·55	7·91	7·51	15·42	10·32	7·76	18·08
1938							16·07	3·15	19·22

(c) Cultural treatment and the depth in inches per day to be kept constant but actual depths and intervals to be varied, e. g. $\frac{1}{5}''$ per day given in one or other of the following ways:—

1" in 5 days
2" in 10 days
3" in 15 days

(d) The study of combined effects of variety, spacing, manures and water-supply on the yield of crops.

On these lines experiments have been commenced in Aduturai, Maruteru, Paddy Breeding station and Central Farm, Coimbatore.

Even in reviewing a year's work, some tangible indications are noted. For instance, experiments on Ragi were conducted on the Central Farm[12] with four variations in interval of irrigation viz. one week, two weeks, three weeks and four weeks and three variations in depth of irrigation, viz. 2 inches, 3 inches and 4 inches. Statistical analysis (vide Tables II, III, IV & V) revealed the following:—

1. In the case of interval, with regard to grain, there was no significant difference between three weeks and four weeks, but within the other variations, the more frequent the irrigation, the higher was the yield.

With regard to straw, within the four variations, more frequent irrigation gave higher yield.

2. With regard to depth, in both the cases of grain and straw, 3 inches and 4 inches were better than 2 inches but 4 inches was not better than 3 inches.

The results of such experiments are of immense value to the ryots and that they do realise it, is seen from the fact that no experiment on the farm has evinced so great an interest from the neighbouring and visiting ryots as this set of experiments.

Results of Irrigation Experiments on Ragi (1938-39), Central Farm, Coimbatore.

TABLE II. Grain-yield. Interval variations.

Particulars.	Mean yield of Intervals. 1 week.	2 weeks.	3 weeks.	4 weeks.	General mean.	Whether general effect of treatment is significant by Z test. P = 0·05.	Standard error of Mean per plot.	Critical difference for significance. P = 0·05.
Yield in decagrams per plot.	1630·5	1432·25	954·75	952·75	1242·56	Yes.	19·72	63·06
Yield in pounds per acre.	1676·2	1472·4	981·5	979·4	1276·52			
Percentage over general mean.	131·4	115·3	76·9	76·7	100			

Conclusion—1 week > 2 weeks > 3 weeks = 4 weeks.

TABLE III. Grain-yield Depth variations.

Particulars.	Mean yield of depths. 2 ac. in.	3 ac. in.	4 ac. in.	General mean.	Whether general effect of treatment is significant by Z test. P = 0·05.	Standard error of Mean per plot.	Critical difference for significance. P = 0·05.
Yield in decagrams per plot.	375·63	436·88	430·06	414·19	Yes.	9·19	26·81
Yield in pounds per acre.	1156·94	1345·6	1324·58	1276·52			
Percentage over general mean.	90·6	105·4	103·8	100·0			

Conclusion—3 ac. in. = 4 ac. in. > 2 ac. in

TABLE IV. Straw-yield Interval variations.

Particulars.	Mean yield of Intervals. 1 week.	2 weeks.	3 weeks.	4 weeks.	General mean.	Whether general effect of treatment is significant by Z test P = 0·05	Standard error of Mean per plot.	Critical difference for significance. P = 0·05.
Yield in quarter pounds per plot.	515·5	446·25	308·00	265·5	383·81	Yes.	9·62	30·77
Yield in pounds per acre.	5997·84	5192·12	3583·54	3089·09	4465·53			
Percentage over general mean.	134·3	116·3	80·4	69·2	100·0			

Conclusion—1 week > 2 weeks > 3 weeks > 4 weeks.

TABLE V. Straw-yield. Depth variations.

Particulars.	Mean yield of depths. 2 ac. in.	3 ac. in.	4 ac. in.	General mean.	Whether general effect of treatment is significant by Z test P=0·05.	Standard error of Mean per plot.	Critical difference for significance P=0·05.
Yield in quarter pounds per plot.	104·5	136·44	130·38	127·94	Yes	3·14	9·16
Yield in pounds per acre.	3647·47	4762·30	4550·78	4465·53			
Percentage over General Mean.	81·7	106·6	101·9	100·0			

Conclusion—3 ac. in. = 4 ac. in. > 2 ac. in.

It may be argued that to translate these results, especially regarding optimum depths, accurately under ryots' conditions will be impossible. We have to admit that we cannot think of the possibility of controlling the depth or quantity of water accurately to the crop requirements in a ryot's field. But such a difficulty applies equally to a case of spacing, say in paddy. If experiments have proved that 9" is the best spacing between plants, surely, this accurate spacing cannot be maintained under a ryot's field conditions. After all, in practical working, what is required is, near about optimum conditions, after it is known what exactly are 'optimum conditions'.

In this connection, an extract from Aduturai Station Report of 1937—38,[11] regarding experiments on paddy states :—

"The results clearly indicated that the application of 1 in. water at four-day intervals or 2 in. at eight-day intervals gave the best yield. So the universal practice of bunding up water to a depth of even 6 in. to 8 in. in paddy fields is a very wasteful method, conferring no benefit to the paddy grower. If the *mirasdars* could be induced not to let in more than 2 in. or at the most 3 in. of water at every irrigation, a great volume of water now wasted, may be kept back in the reservoir from the month of October onwards for ensuring a plentiful supply in the following June to start the new paddy season with."

It is clear from the above extract how a definite conclusion of the kind mentioned above can be put into practice with profit.

Water-logging and formation of alkali lands. A review of the history of irrigation development has shown, that many of the troubles of which the above are the most important, have been due to unfavourable conditions of soil, water-supply and drainage, which were not realised before development was started. The causes were a lack of knowledge regarding,

1. the soil characteristics that contribute to success under irrigation,
2. the quality of irrigation water,
3. the need for effective drainage.

Success could be achieved by a rational classification of land for irrigation based on two factors, viz.,

1. The soil must not contain excessive quantities of alkali salts.
2. Special care should be taken to ascertain that natural drainage particularly below ground, is adequate or that adequate artificial drainage can be provided at a reasonable cost.

Also information as to the quality of water should be complete. For, irrigation water, unlike rain water, contains dissolved substances, often in substantial quantities. These substances accumulate in the irrigated soil and may in time cause vast changes in its character. It is interesting to note that irrigation water during a season's crop in some cases has been estimated to contain as much as a ton of dissolved solids to an acre[5]. The harm that could be done by excess of salts can be understood when it is remembered that the maximum safe quantity of soluble salts as manures is only about 300 lb. per acre. Existence of injurious salts in the water will, therefore be definitely dangerous.

Thus where the potentialities of injury of either kind exist, remedial measures may be taken often at small expense. It is more difficult to deal with it after it has developed.

These difficulties were earlier realised in the U. S. A. and Egypt. It is for these reasons that the Royal Commission on Agriculture[6] laid down that before new projects are initiated, the agricultural department ought to be consulted fully, with regard to the suitability of the soil for irrigation, the conformation of the subsoil, the nature of the crops that would be grown and the character of supply that would be required for them. An instance of this co-operation is the Tungabhadra project where investigations on these lines have been undertaken on the Research Station at Siruguppa.[10]

Such co-operation between the two sister departments will undoubtedly contribute to the general prosperity of the country.

Acknowledgments. I am grateful to Mr. R C. Broadfoot, Superintendent, Central Farm under whose guidance and encouragement it has been my privilege to work. I am thankful to Mr. M. Kanthiraj who has been always willing to help me with suggestions.

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Cashewnuts.*

BY C. T. ITTYACHAN, B. Sc., Ag.,
Assistant in Oil Seeds.

Introduction. The cultivation of money crops in an agricultural holding, however small it be, is a question of necessity. For, it is with the money thus realised that the cultivator is able to purchase necessities of life other than those produced on his farm. Unfortunately these commercial crops besides taking the most fertile bit of his land require more money as well as care for their successful cultivation and preparation for market. Among a few exceptions to this category cashewnut stands foremost. It thrives well on lands where no other crop will grow. Once the plantation is started it requires no further care, such as cultivation, manuring or preparation of the produce for the market. In fact a cashewnut plantation is as good an asset as a sound dividend-paying investment.

Known by different names in the languages of the province - *kappalandi* in Malayalam, *gerubeeja* in Kanarese, *mundirikottai* in Tamil and *gerupappu* in Telugu—cashewnut (*Anacardium occidentale*. Linn) is familiar to every Indian household though it is not an article of staple diet. In foreign countries it is in great demand, especially in the United States of America and United Kingdom, who are the largest consumers of the commodity in the world. A hitherto neglected crop the Indian cashewnut has slowly but steadily captured the foreign market. The setback received during the Great War has been overcome and the trends of the trade assure a bright future. The magnitude of the cashewnut industry in India can be well understood from the fact that the annual export value exceeds Rs. 115 lakhs giving employment to 10,000 to 16,000 people in the season and west coast plays an important part in production and trade. The cultivator and the commercial man have not as yet realised fully the economic importance of the industry even though it gives a commodity classed all the world over as a delicacy and offers several other economic by-products. The Indian production is far below the foreign demand. To engage the men and the machinery of the industry for a greater part of the year large quantities of African nuts are imported every year by the factory owners in India and as much as 17,000 tons of raw nuts have been imported during 1936—37. So

* Paper read at the M. A. S. U. Conference, July 1939.

there is scope to extend the cultivation of cashew in the waste lands of some districts of the east and west coasts of this presidency. The object of this paper is to create interest in those who feel like taking up this industry and furnish them with information on all aspects.

Original home and habitat. The cashewnut is believed to be a native of South America. It was introduced into India by the Portuguese for the main purpose of checking erosion on the sandy coasts of the peninsula. It has got thoroughly acclimatised in this country and is growing wild on the west coast from Cape Comorin to Bombay. It is also found cultivated on a small scale on the east coast districts of Vizagapatam, Godavari, Guntur, Chittoor, Chingleput, North Arcot, South Arcot, and Tanjore. Outside India it is met with in tropical America--from Mexico to Brazil, east and west coasts of Africa, Madagascar, Indo-china, Malayan peninsula, Philippine Islands and Ceylon.

The plant. The cashewnut tree is a tropical evergreen growing to a height of thirty to fifty feet depending on the fertility of the soil. It grows well even on very poor soil and is one of the hardiest drought-resistant plants. There are several types of trees exhibiting variations in the season of bearing, shape and colour of the fruit, size, shape and weight of the nuts, whiteness and hardness of the kernel, etc. The cashewnut tree has more seasons of growth than one. The first vegetative flush appears in summer following the fruiting season. A second but a very moderate flush is put forth during the middle of July, when heavy rains are received. The third or the main flush is in November and in a month's time the flower panicles appear. The fruits are formed in summer and the nuts gathered from February to May.

Cultivation. (i) *Soil and Climate.* The tree is capable of thriving under widely different conditions of soil and climate. Though systematic cultivation and manuring are not usually given, yet the tree has been observed to respond to such treatments. The plant grows best on light sandy soils and on the shallow laterite slopes as well. In South Kanara, Malabar, Cochin and Travancore it grows on red laterite soil under a rainfall of about 120 to 150 inches and equally well on the sandy tracts of the east coast having a rainfall of about 35 inches. In the west coast districts and in the states of Cochin and Travancore cashewnut occurs on hill slopes mixed with other trees. But the Konkan farmers of Bombay are inclined to believe that the cashewnut trees have a peculiarly exhaustive or toxic effect on the soil and that no crop will flourish in the neighbourhood of cashewnut trees. Consequently only waste lands and hilly places unsuitable for other crops are mainly utilised for its cultivation.

(ii) *Sowing.* Selection of seednuts plays an important part in the successful raising of a good cashewnut plantation; generally medium sized heavy nuts are preferred for sowing. In some places like Ceylon seedlings are raised in nurseries and transplanted, but they do not stand transplanting well probably because the tap root gets damaged during the process. The general practice in the west coast is to sow seeds 'in situ' in the south-west

monsoon, in pits 1′ × 1′ × 1′ size, twenty to twenty-five feet apart depending upon the nature of the soil. Sometimes even 150 to 200 trees are grown per acre. But the optimum is about 100 trees per acre.

(iii) *Growth and Bearing.* No further expenditure is incurred in the after cultivation of the garden except for fencing the plantation for the first two years to protect the young plants from the ravages of cattle. The trees begin to bear after a period of three years and continue to yield for a period of fifteen to twenty years. There are, however, plants which have given good yields even up to thirty years. Thereafter they exude a gummy substance, which renders them unfruitful. On the west coast, the flowers appear from December to February. The fruit is developed on the pyriform succulent fleshy body, formed by the thickening of the fruit stock or pedicel and becomes ready for harvest in two to two and a half months. It is noticed on the west coast that the bearing is maximum in the year when there is a long and hot summer showing thereby the existence of a definite relation between weather conditions and the setting of flowers.

(iv) *Harvesting.* The fruits with the 'apple' are plucked in February, March and April by coolies engaged for the purpose with a long bamboo having a hook at the tip. Economic yields are obtained from the seventh or the eighth year. The yield varies from fifteen to forty pounds of nuts per tree. Either the owner harvests and sells the produce or lets out on contract the usufructory rights when the harvesting has to be done by the purchaser. The latter method is more convenient although it involves a certain amount of risk to both the parties.

(v) *Pests and Diseases.* The only important disease which attacks the cashewnut tree is the "Die-back disease". This has been recently found in a virulent form in certain localities of the west coast causing great loss by the complete drying of the trees. No insect pests of importance have been noticed so far attacking the cashewnut tree.

The Economics. The total expenses in bringing up a garden is more or less negligible and the only sum that has to be invested is mainly for the purchase of the land, sowing and fencing. Apart from the cost of the land the other expenditure may come to Rs. 10 to 13 per acre till the trees come to bearing. For the first five years of bearing, an average of fifteen pounds of nuts per tree may be expected to be obtained and there after twenty-five pounds per tree. In addition 100 to 150 lb. of "apple" will be obtained from each tree per year. The number of nuts per pound varies from 60 to 150 on the west coast and 30 to 125 in Ceylon. The east African nuts are smaller than those of the west coast. The present market price for the unshelled nut is Rs. 1—12—0 per thulam of 37½ lb. in Malabar i. e., nine pies per pound. Generally the ryots sell the nuts locally to the middlemen. Sometimes the ryots find markets locally for apples also and the usual rate is one anna per hundred. It is found from the following table that a net income of Rs. 70 to 90 could be obtained from one acre of good plantation, if the nuts are disposed locally unshelled.

Cost of cultivation for one acre of 100 trees till bearing.

	Rs.	A.	P.
Making 100 pits	1	8	0
Seednuts – 200	0	4	0
Sowing	0	2	0
Fencing and repair	10	0	0
Earthing up the trees	0	4	0
Lease for three years	12	0	0
Total.	24	2	0

This sum of about Rs. 25 is the capital investment for cultivating a garden of one acre for the first three years and the interest on it is negligible.

Annual average expenditure per year of the first five years of bearing.

Harvesting charges	18	12	0
Lease amount	4	0	0
Miscellaneous	1	0	0
Total.	23	12	0

Annual average income per year of the first five years of bearing.

1500 lb. nuts (15 lb per tree) at Rs. 1—12—0 per thulam.

Annual average income per year for the first five years of bearing.

1500 lb of nuts (15 lb per tree) @ Rs. 1—12—0 per thulam	70	0	0
Less expenses	23	12	0
Net profit.	56	4	0

The disposal of apples is not certain in all years and it may not add anything to the income.

Annual average income per year after the eighth year of planting.

2500 lb of nuts	116	10	8
Total expenses	23	12	0
Net profit	92	14	8

In some places tender nuts are in demand and they fetch about one and a half to two annas per 100. Small quantities of unshelled nuts are also exported to foreign countries. South Kanara nuts are considered to be inferior in quality to the Malabar and Goa nuts.

Processing or curing of the cashewnut. The exportation is mainly of cured nuts and the curing of nuts forms a cottage industry on the west coast. There are also several factories engaged in the curing of cashewnut and they buy nuts at Rs. 7 to 7—8—0 for a bag of 130 lb. of nuts. The centres of curing are Mangalore and Rajahmundry in Madras, Quilon in Travancore state, Malvan and Goa in Bombay. The process of curing involves several operations like roasting, shelling, peeling, sweating, grading and packing.

(i) *Roasting.* The nuts are uniformly dried and roasted in open iron pans three feet by two feet in size, over mud furnaces stirring vigorously all the time to ensure uniform roasting. Occasional sprinkling of water is necessary to prevent the shells from getting charred. Generally the cashewnut shell itself is used as fuel. The nuts are spread out on the floor after this operation. Two men can roast about 6720 lb. of nuts per day of six

hours. The oil on the nuts is completely dried by sprinkling ash over it; otherwise being caustic it blisters the skin. While roasting a certain amount of oil is obtained which fetches one anna per bottle locally.

(ii) *Shelling*. The shelling is generally done by women on contract system at four pies per pound of kernels obtained. Each woman will shell nearly 16 to 20 lb. per day. The kernels obtained by shelling will be 25% to 30% of the whole nut and out of this kernels 75% to 89% will be 'wholes' and 11% to 25% will be 'brokens'.

(iii) *Peeling*. The kernels obtained after shelling are either sun-dried or dried properly over a furnace in wire gauze trays at 70 degrees centigrade and the outer skin is removed, which will be nearly 10% to 15% of the whole kernels. The drying also facilitates the removal of moisture from the kernels. The usual rate for peeling on the west coast is four pies per pound of 'wholes' and two pies for 'brokens.' Usually women coolies are employed and they earn five to six annas per day.

(iv) *Sweating*. Slight sprinkling of water is done after peeling to prevent splitting and breaking of kernels during transit.

(v) *Grading*. For the convenience of marketing, the kernels are graded into four classes as—

1. Good big kernels
2. Good small kernels
3. Splits and brokens
4. Rejects and spoils

Grading also is done by women and one woman will sort 55 to 69 lb. of kernels per day of six hours earning four to five annas.

(vi) *Packing*. The kernels are packed in small sized tins containing 25 lb. of kernels in each. The tins are vacuumised and sometimes filled with carbon dioxide, which is found to be the best method to stand storage for periods extending even up to eight or ten months. The kernels are also locally sold at the rate of five to six annas per pound for 'wholes' and three to four annas for 'brokens.'

Cost of production of 100 lb. of kernel in the factory.

	Rs.	A.	P.
Nuts 390 lb. @ Rs. 7—8—0 per bag of 130 lb. ...	22	8	0
Roasting	0	10	0
Shelling (4 ps. per lb.)	2	7	0
Peeling (Do.)	2	1	4
Grading	0	6	0
Miscellaneous expenditure	1	7	8
Total. ...	29	8	0
100 lb. of kernels if sold locally @ 5 annas per lb. ...	31	4	0
Shell oil (10% giving 25 lb.)	1	0	0
Total. ...	32	4	0
Less expenses. ..	29	8	0
Net profit. ...	2	12	0

Thus a profit of Rs. 2 to 3 is obtained in disposing produce as kernels instead of selling as whole nuts.

The products and their utilisation. The best economical return with minimum cost of production is a unique feature in growing cashew. Every part of the tree is useful and valued by the people and the by-products obtained from it seem to be popular in modern markets.

(i) *Tree.* The tree as a whole is used as a good source of firewood throughout the west coast. The wood is used for the preparation of charcoal and for making country boats and packing-cases. The resinous gum which exudes from the bark of the tree has well known insecticidal properties and is also used as a tanning agent. The sap obtained from the incisions on the bark is utilised as an indelible marking ink. The gum being insect proof can be used in book-binding.

(ii) *Nut.* (a) *Kernel.* In Europe cashewnut kernel is considered as a dessert nut and it is used frequently in making confectioneries. "Americans are eating more cashews than they used to" says the Bureau of Agricultural Economics. In the west coast the kernels from tender nuts are used for *curries, payasams,* etc. The kernels contain a large amount of protein as can be seen from the following figures:—

Analysis of kernels.

	%
Protein	14·43
Ash	2·80
Fat	4·56
Fibre	1·27

(Brain, C. K.)

The kernel, just like almond and walnut, forms a common ingredient of many varieties of cakes and sweetmeats which are popular in western countries. The following table gives a comparison of cashewnut with almond and walnut and justifies its name— "the tropical almond."

TABLE I. The Chemical analysis.

(H. H. Mitchell and Jessie, R. Readles).

Description of nuts.	Moisture %	Crude protein %	Ether extract %	Crude fibre %	Nitrogen free extract %	Ash %	Calcium %	Phosphorus %	Gross energy in calories per gm. (Bomb calorimeter)
Cashewnut fresh	4·39	19·52	48·70	1·20	23·72	2·47	0·041	0·507	6·48
Almond bleached	4·56	21·94	56·75	3·34	10·29	3·12	0·251	0·527	6·76
English walnuts fresh	4·39	21·16	61·91	2·35	8·07	2·12	0·096	0·463	7·32

From the above table we find that there is not much difference between the three kinds of nuts in their chemical constituents. The true digestibility and the biological value of the three nut proteins is given below:—

TABLE II

(H. H. Mitchell and Jessse. R. Readles).

Source of protein	True Digestibility %	Biological value
Cashewnut	96·23±0·16	72·50±0 66
Almond	93·95±0·23	50·84±0·37
English walnut	84·11±0·22	55 89±0·92

It may also be stated that cashewnut has been declared to be superior to almond or walnut in its true digestibility coefficient and biological value. Its nutritive value is further enhanced by the presence of vitamins A and B_2. The kernel gives a light yellow, bland oil which is very nutritious and forms 40% of the kernel. As a substitute for almond oil, this oil can be used with much advantage in pharmaceutical preparations. The thin pinkish coloured testa or seed coat together with the broken kernel tips forms a good poultry feed. The analysis of the mixture is as follows :—

	%
Water	8·1
Protein	7·6
Fat	12·3
Carbohydrates	59·2
Fibre	11·0
Ash	1·8

(Joachim).

The nutritive value of this feed is very high giving a ratio of 1 : 11·5.

(b) *The shell.* The cashewnut shell oil which is 29% of the shell is reddish brown in colour and is esteemed as a valuable commodity in the market. The constituents of the oil are anacardic acid, gallic acid, and cardol. Though the shell contains 29% of oil, only 10 to 15% is obtained by the ordinary extraction. A ton of cashew shells on destructive distillation gives 6,000 cubic feet of gas of a calorific value which compares very favourably with coal gas. The charcoal obtained is one-third of the shell and has a calorific value of local coal. Its use as smokeless fuel is suggested. The oil is used in the preparation of different kinds of varnishes, moulding compositions, insulating coatings, inks, etc. The oil is known for its use as a preservative for boats and fishing nets and it has got the most valuable property of preventing termite attack. It is believed that the oil is a good valuable specific against certain forms of leprosy and other skin diseases. It is reported that this oil with kerosene or high speed diesel oil in the proportion of 1 : 19 can be used for killing the larvae of mosquitoes.

(iii) *Cashew apple.* The swollen pedicel called the apple is generally eaten by the poor classes on the west coast. The juice of the apple which is about 65% of the weight of the fruit, can be fermented either to yield a beverage or to produce vinegar. The juice gives the following analytical figures :—

pH. value	4·2 to 4·6
Total solids	10·6%
Ash	0·36%

(Srinivasan).

Out of the 10·6% of the total solids of the juice 94% is sugar, the remaining parts being acids, tannins, pigments and an astringent principle.

	%
Acidity in grammes of sulphuric acid	0·28
Reducing sugars	11·96
Non-reducing sugars	0·66
Total sugars and traces of pectin	12·62

(Sayed).

From the above analysis it is found that the juice contains a large percentage of invert sugars, which is nearly, 7% of the fresh weight of the fruit. The juice can be converted into a syrup to preserve the invert sugars, which are noted for their suitability for inclusion in infant and invalid foods. The juice is sometimes used as a remedy for dysentry because of its high tannin content. When mixed with iron sulphate it makes an excellent hair dye. The fruit is also eaten as a remedy for scurvy since it contains vitamin C.

Export and import. Due to the recent fillip received by the growing popularity of the cashewnut in the confectionery trade of America and Europe an increased demand in foreign countries is observed, and this has resulted in the present export trade of Indian cashew kernels. Refering to previous years there was a lull in the trade in 1914 due to the Great War. But further rise was observed after 1920. It is an accepted fact that India takes the monopoly in the production of cashewnuts. The progress of the export trade is much better understood from the following table:—

TABLE III. Cashew kernels exported from India in millions of lb.

Year	To U. S. A. Shippable	To Europe and other countries & consumed in India.		Total.
		Shippable	Non-shippable	
1925	1·5	1·00	0.25	2·75
1926	2·5	1·25	0·37	4·12
1927	4·0	1·50	0·55	6·05
1928	5 0	1·25	0·67	6·92
1929	7·5	2·00	0·95	10·45
1930	8·5	2·00	1·05	11·55
1931	9·0	2·50	1·15	12·65
1932	9·7	2·80	1·25	13·95
1933	11 3	2·70	1·40	15·40
1934	15·0	3·50	1·85	20·35
1935	23 0	5·50	2·85	31·35
1936	30·0	5·00	3·50	38 50

From the above table it is understood, that the export trade of cashew kernel in India has made steady progress from 1925 onwards and total export has increased from 2·75 million pounds in 1925 to 38·5 million pounds in 1936. These figures clearly show that the Indian cashewnut industry is slowly capturing the market and there is yet considerable scope for the extension of the markets in Europe and India. It is recorded that India produces now more than 33,000 tons of nuts and in addition imports more than 17,000 tons of nuts from foreign places like Kenya colony, Tanganyika, Portugese East Africa. etc. The export trade has rapidly developed along the several centres of the west coast of India, of which Mangalore was the chief. But now Cochin is considered to be the chief

exporting centre, while South Kanara is the largest producing centre. Bombay is another centre in India. Alleppy is the port of shipment in Travancore and the exports reach nearly 20 lakhs of pounds of kernels. Bombay stands only next to Madras in the export and import trade of cashewnut as can be seen from the following table :—

TABLE IV. Statement showing the quantity and value of cashewnuts imported into Madras and Bombay Presidencies from foreign countries during 1936-37.

Country of consignment	Madras Presidency		Bombay Presidency	
	Quantity	Value	Quantity	Value
	Tons	Rs.	Tons	Rs.
Kenya Colony	159	19 527	414	57,384
Tanganyika Territory	...	...	32	3,654
Portuguese East Africa	9,788	12,82,602	5,832	7,45,020
Union of South Africa	1,087	1,45,569	...	...
United Kingdom	1	900	...	...
Ceylon	...*	62	...	...
Total.	11,035	14,48,660	6,278	8,06,058

* Less than 1 ton (about 3 cwt.)

TABLE V. Statement showing the quantity and value of cashewnut kernels exported from Madras and Bombay Presidencies to foreign countries during 1936—37.

Country to which shipped.	Madras Presidency		Bombay Presidency	
	Quantity.	Value.	Quantity.	Value.
	Tons.	Rs	Tons.	Rs.
United Kingdom	582	6,09,766	69	64,450
Maldives	(a)	110	...	...
Ceylon	(a)	38	...	...
Straits Settlements	10	8 929	...	...
Federated Malay States	6	4,681	...	...
Union of South Africa	15	16,970	...	...
Commonwealth of Australia	36	19,100	...	...
Canada (Atlantic Coast)	158	1,89,095	...	...
New Zealand	16	19,687	...	...
Finland	3	3,875	...	...
Sweden	14	12,310	(a)	360
Belgium	156	1,13,540	79	66,400
France	322	2,28,729	5	4,540
Netherlands	40	40,875	8	6,995
Germany	7	6,059	...	...
U. S. A. (Atlantic Coast)	6,724	78,97,190	1,088	11,36,965
U. S. A. (Pacific Coast)	710	8,00,613	143	1,58,213
Palestine	...	..	1	1,350
Norway	...	...	(a)	50
Other States in Arabia	...	...	(a)	280
Total.	8,799	99,71,567	1,393	14,39,603

(a) Less than 1 ton in each case.

Thus out of 10,192 tons of kernels exported, United States of America alone consumed: 8,665 tons, United kingdom 649 tons, Canada 158 tons,

France 332 tons, while the other countries shared the remaining 402 tons. As regards the quantity of imported nuts is concerned, Madras gets nearly double the quantity than that of Bombay.

TABLE VI. Import trade of cashewnut from the foreign countries during the last three years.

Year	Foreign Imports.				Total	
	Madras		Bombay			
	Tons	Rs.	Tons	Rs.	Tons	Rs.
1934—35	11,925	13,83 640	+	+	...	...
1935—36	12,764	16,80,836	3,532	4,43,846	16,296	21,24,682
1936—37	11,035	14,48,660	6,278	8,06,058	17,313	22,54,718

It is understood from the above table that the importation is more or less stationary for the last three years. Hence more local production of cashewnuts is required to meet the needs of the factories whioh control the oversea's trade.

Future of the Industry. Though India has got the monopoly of the cashewnut trade in the foreign markets, it is rather strange to observe that such an advantage is not properly utilised for the further development of the industry. Importation of cashewnut from Africa indicates only the scarcity of nuts for the Indian factories. At present we have got only about two dozen factories mostly distributed on the west coast. It can be anticipated that in the future we may have to face keen competition in the cashewnut industry from other tropical countries and this must be considered a potential threat against the present industry, especially of our presidency. Hence it is time for us to take proper steps for the advancement of the industry. The Agricultural Department of Bombay presidency has recently been conducting scientific researches on this valuable and nutritious product. The authorities of the Canal Zone Experimental Gardens have introduced for trial several varieties of cashew.

With the increasing importance of the cashewnut it was felt that a systematic study of the crop was necessary and a modest beginning in this direction was made by the Oil Seeds Section of this Department. A block of five acres of sandy soil was planted to cashewnuts in 1931—32 at the Agricultural Research Station, Nileshwar No. III, South Kanara district. The early growth was good and more than half the number of plants flowered in the third year. Various observations were and are being made to gain a better insight into the growth and yield complex of the plant. A large number of one to three years old seedlings have been examined for their roots and it has been found out that the cashewnut has a remarkably well developed root system, much better than most of the other fruit trees. Studies in germination, seednut and seedling selection, etc., are in progress and the results are awaited with great interest. More than 11,000 lb. of selected seednuts have been distributed by the Oil Seeds Section during

the last six years, and at a conservative estimate at least 300 acres must have been planted with these seeds.

Though our presidency and the neighbouring states lead in the production of cashewnut, very little is being done for the development of the industry. Therefore it is essential in the interests of our presidency and also of the Indian cashewnut industry, that the cultivation is widely extended and new markets for this nutritious and useful product be developed in other parts of the world, especially in the British Empire. An improved cashewnut industry is an asset and the following steps if taken in time will surely go a long way in establishing this industry on a firm and secure foundation.

(i) The department should do more propaganda for inducing ryots to plant their waste lands with cashewnut trees.

(ii) The ryots may be permitted to grow cashewnut trees in government porambokes and waste lands.

(iii) To evolve better yielding and disease resistant types and for finding out new industrial uses for cashew by-products scientific investigations should be undertaken and the government should finance new schemes of research in the above direction.

(iv) Cooperative societies should be started for better marketing.

(v) The provincial governments should be induced to address the Central Government for fixing standard grades for marketing.

(vi) By propaganda and publicity new markets should be created abroad.

(vii) When the internal supply of nuts has sufficiently increased to meet the needs of the factories, suitable tariff regulations or legislative measure must be adopted to prevent the import of nuts from foreign countries.

It is learnt from a recent Government communique that the Government have approved of a scheme of the Forest Department for planting cashewnuts in unreserves of South Kanara District, and have sanctioned the appointment of the necessary staff for the purpose. This definitely shows that the Government are fully alive to the importance of the cashewnut cultivation.

Acknowledgments. The author is grateful to the Oil Seeds Specialist Mr. C. M. John for permitting him to utilise the departmental work on cashewnuts and for the guidance and encouragement so freely given.

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The Scope of Pillipesara (*Phaseolus trilobus*) in the Solution of the Fodder Problem.

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Introduction. In the feed of animals, carbohydrates, proteins, fats, minerals and vitamins are the most important constituents. While the straws of the various cereals are the main sources of dry fodder upon which an ordinary ryot falls back for the maintenance of his livestock, the value of a proper ration of green food especially to milch cows and young growing stock is not for a moment to be minimized. Digestible green forage gives all that an animal physiologically needs. Grasses of pasture lands, sorghum, maize, sunnhemp, and *pillipesara (Phaseolus trilobus)* are the chief sources of green fodder. To these may be added exotic crops like guinea and elephant grasses, and lucerne *(Medicago sativa)* all of which are, however, confined in South India to the neighbourhood of agricultural research stations. The cultivation of grasses for fodder requires devoting to them, permanently or for a long period, of a sufficient plot of land which the great mass of ryots cannot afford to. The village pasture grounds where the cattle of the place graze are not only insufficient but incapable of affording grazing during the warm dry months of the year when the need for green forage is felt most. Sorghum, and to a less extent maize are grown in certain parts of the South for cutting and feeding green to cattle. The surplus, if any, is generally dried and made into hay and stacked for later use. The same is the case with sunnhemp in Kistna, Guntur, and parts of Godavari

and Vizagapatam. These are good so far as they go. But *pillipesara* seems to have for all practical purposes certain advantages over the rest of its kind. It continues to remain on the field green and succulent over a long period or until it is ploughed in, when it serves as green manure. The same cannot be said in the case of others. They are to be cut at the flowering or seeding stage and either made into hay or converted in good time into silage if the benefits of green fodder are to be preserved. Being a slender spreading fodder crop, the fibre content in *pillipesara* does not get increased after the seeding stage to the extent of rendering itself poor or useless as in the case of sunnhemp. Its thin seed pods which are usually fed or grazed with the stalks and foliage are much relished by cattle and therefore the valuable nutrient material in the seed is not lost. Further, along with sunn-hemp and lucerne it stands in the happy company of leguminous crops which are known to build up the nitrogen content of the soil in which they are grown through the formation of root-nodules by the relative nitrogen-fixing bacteria.

Cultivation as a pure crop. Among the known fodder crops, *pillipesara* is perhaps the most easily grown. Moisture-retaining clay soils accommodate the crop best, although all soils ranging from clayey to loamy will amply meet its requirements. Its habit being of a creeping nature, it is conveniently sown in a variety of ways either as a pure crop or mixture. For a pure crop in wetland, seeds at the rate of 20 to 25 lbs. are sown two or three days before the harvest of paddy and no aftercare is required except to make out a few drains where it is thought necessary to remove the excess water. This aspect should always be kept in mind in order to facilitate good germination. If, however, water-logging conditions exist at about the time of harvest of paddy, sowing of pillipesara should be deferred till after paddy is harvested and the excess of water in the field drawn off. When the soil is still moist, the seed should be sown broadcast and a brush harrow or a moderately heavy levelling-board run over is sufficient to effect good germination. In both the cases it will be seen that ploughing is dispensed with and moisture in the soil, as much as could be retained compatibly with the requirements of good germination, is conserved and utilized for the future growth of the crop. In many villages, low-lying wetland, in which no *punasa* or *pyru* crops are or can be grown on account of the heaviness of the soil, is at present being left uncultivated after taking a single paddy crop. It is quite possible and highly desirable that *pillipesara* is sown in such areas and the fodder problem in the villages thereby relieved.

Cultivation as a mixed crop. *Pillipesara* may also be grown mixed with *pyru* gingelly. After paddy, the land is ploughed three or four times, and some time in January, gingelly seed is as usual sown broadcast immediately followed by *pillipesara* seed at the rate of 12 to 15 lb. per acre. Both the seeds are then covered by ploughing twice. By the time gingelly is harvested after about three months, *pillipesara* grows sufficiently well and will be the only crop on the field, till again paddy comes in. Besides, it is

advisable to sow pillipesara wherever is possible, e. g., in gardens allowing sunlight within, such as of coconut, mango, and other fruit trees, on field bunds of paddy, and in pasture lands. It will be enough in such cases if the seed is sown once in two years at the beginning of the rains. Grass mixed with *pillipesara* is highly relished by cattle, besides the fodder thus obtained being larger in quantity.

Harvest and Yield. In about two months from the time of sowing, *pillipesara* will be ready for its first cutting, the exact period depending upon the moisture content of the soil. The crop may then be either cut and fed to or directly grazed by cattle. At the beginning, care should be taken to adjust the quantum of feed as animals suddenly turned to new appetizing foodstuffs are likely to consume more than they are able to digest. In moisture-retaining heavy soils or with the aid of one or two timely showers or irrigations, *pillipesara* yields upto 30,000 lb. of green fodder per acre. But in lighter soils and under adverse circumstances the yield may go down as low as 10,000 lb. To maintain one grown-up animal, 25 cents of land will be required, on an average, to be sown with this fodder crop.

Conclusion. In most of the villages facilities for irrigation during the hot months are few; as such, irrigated fodder crops are seldom attempted by the cultivators. But *pillipesara* comes in handy in many ways to solve the fodder problem in a large part of South India. Will all those interested in rural uplift look around and see whether or not this humble vagrant weed can be brought to supply cheap and efficacious fooder usually so scarce?

[*Pillipesara* has been successfully grown for fodder and as a green manure crop on the Agricultural Research Stations at Guntur, Nandyal, Hagari, Pattukottai, Aduturai, Maruteru, and Coimbatore, and yields of green stuff ranging from 7 to 86 thousand pounds per acre have been recorded.—*Editor, M. A. J.*]

SELECTED ARTICLE

The Principles of Manufacturing Fruit Juices.

(*Translated by N. K.*)

The manufacture of fruit juices, not only of fruits like pineapple which were long established, though in restricted distribution, but also of fruits like the tomatoes, has risen up very much during the last eight years. Circular 344 of the Agri-experiment Station of the University of California (Berkeley Cal.) gives very exact information for the Industrial preparation. For small scale industries the *Revue Agricole de l'Isle de la Reunion* vol. 43. 1938: p. 212—215 may be referred. Apart from these the conservation of the fruit juices has been specially treated in the *Bulletin of the Imperial Institute, London* 36. 1938: p. 334—349 and in the *Malayan Agricultural Journal* 26.1938:472—477. The basic principle of the whole of the fruit juice preparation is the retention of the aroma and taste of the original fresh fruit to the utmost possibility. The conservation of the nutritive value of the juices becomes secondary when compared with the preservation of the vitamins (B and C) contained in them. The rest of the nutritive materials—sugar, acids, mineral salts—are capable of staying and do not get spoilt during the process.

The industrial preparation falls under the following phases:—Choice and preparation of the fruits; extraction of juice; clearing of the juice with a view to improve its appearance and conservation. There are special machines for each kind of fruit variety. Throughout the process of the manufacture all contamination with air must be avoided because specially in the citrus fruits the quality gets spoilt and vitamin C is destroyed through oxidation. Since complete exclusion of air during the manufacture is not usually possible, towards the end of the process the juice is freed from air through vacuum. As far as possible all contamination with metals is to be avoided. The instruments and apparatus must either be of glass or of metals coated with glass or at least of rust free metals (aluminium, nickel, certain copper-nickel alloys or stainless steel).

In the choice of the fruits it must be borne in mind that not all fruits nor all the fruits of one variety are suitable for extraction. It is imperative to choose only healthy, ripe, uninjured fruits. Storage should be as far as possible avoided, since the staying power of the individual fruits may vary. The fruits must be washed with great care, particularly in case any fungicidal or insecticidal chemicals have been used. In view of the machines used the fruits must be graded through a wire sieve. The following tropical and subtropical fruits are of special importance in fruit juice manufacture.

1. *Citrus varieties.* In the first place comes grape fruit; next comes the tangerines and tangelos*. Orange and particularly lemon are very difficult to preserve, the latter is manufactured in small quantities for the sake of perfumeries and confectionaries, while the orange juice is mostly replaced by the concentrates. Varieties and the condition of the ripeness are of very great importance. In California the Valencia oranges come to market from April-November but are used in the juice manufacture only for 6 weeks.

2. *Passion fruit (Passiflora edulis).*

3. *Pomegranates*—This gives a juice which in a pure state is very sharp or acid, but is best suited as a blend for other juices.

4. *Grapes*—The various labuska varieties are preferred to all other and secondly in mixtures coloured juices are preferred. The acidity should be high.

5. Pineapple.

In the extraction of the juice the admixture of the other fruit contents, must be avoided. It is the worst method to extract the juice from the halved citrus fruits through rotating on ribbed and similarly constructed extractors. In the passion fruit the juicy flesh of the fruits with the seeds are removed from the cut fruits usually by a rotating press (burring). For the separation of the seeds a particular method of pressing is necessary which is attained in the extractors by a forward running screw. In the pomegranates the edible portion is confined to the berry-like arils or fruit bodies, because the rest of the fruits are too rich in tannins. The extraction of the grape juice is very laborious because it is necessary to remove the colour which is difficultly soluble in the cold. This is done through heating the completely or partially pressed out juice with the skin and finally pressing it out again. In the case of the colourless grapes heating is not only unnecessary but even injurious.

Clearing. While formerly a completely cleared juice was preferred, now-a-days such a thorough clarification is considered not desirable since many of the small particles that are present in the juice are held to be of primary importance for the taste and the nutritive value. Thus for the orange juice the yellow chromatophores present are decisive. Of course the suspended particles should

* Tangerine is a loose jacket orange (mandarin). Tangelo is a hybrid between Tangerine and Pomelo. (Translator's note.)

not be too large and the correct amount allowable is hard to estimate. Larger particles such as the seeds, pieces of skin or the fleshy portion of the fruit must be always removed (sieved). Besides these, there remain finer particles as also the gum and pectin substances in colloidal form. The first are removable through decantation or sieving or filtering and the latter through precipitation with gelatin and tannin (on the average 1·25 oz. tannin and 1·5 to 6 oz. gelatin for every 100 gals), through dissolution by enzymes and through coagulation by heat or cold. In the case of the grape juice the removal of the tartarates is effected by repeated crystallisation, by supersaturating the solution, by heat or cold, the second of which is quicker.

The most important preserving or conserving method is pasturisation. This is conducted in two ways, through heating at low temperatures for a long time or a short heating at a higher temperature. The second method the so called lightning-pasturisation, has certain advantages, because the juice after a long heating is not palatable. The juice is heated for 10 seconds to 1 minute at 185 -190°F. (85—88°C) and then cooled to a temperature suitable for pouring into the containers and filled, closed and quickly cooled down. Care is to be taken that the whole of the juice is heated through and through which depends upon the medium of heat (steam transfers the heat slower than water), the difference in temperature between this and the juice, the thickness and structure of the vessel and lastly on the nature of the juice itself (the viscous juices conduct heat slower than thinner ones). In America a special process called the 'Stero-vac' which combines the heating, quick cooling and exhaustion of air, is used.

Further conserving methods are the freezing, the Matzka-process and a few other less important methods. The freezing is the most ideal process but is beset with great difficulties. Moreover all the micro-organisms which would destroy the fruit juices will not be killed, so that on rewarming deterioration may set in and the juice will have to be stored always frozen. The Matzka process combines the lightning-pasturisation and the sterilisation through metallic silver which process depends on the killing effect of the oligodynamic working of the metal on the organism. This method is used in U. S. A., Canada, Sicily, Holland etc. The chemical preservatives are sulphurous acid (as sulphur dioxide or potassium bisulphite) and sodium benzoate. Their presence should be indicated in prominent letters on the labels.

As vessels for the fruit juices, formerly almost exclusively glass alone was used. Now in general are preferred cans made of specially treated tin (pure tin has a bad effect on the fruit juice). In this for each kind of fruit juice separate cans are prepared (e. g. for the citrus juice the so called citrus enamel lined cans). The filling in after pasturisation shall be done in as warm a condition as is possible. For sterilising the fastener it is advisable to turn the vessel up side down or laying it on its side.

Among the special preparation methods mention may be made of the manufacture of fruit syrups and the concentrated fruit juices. Fruit syrups are mostly from citrus juices. The preparation consists in the addition of sugar (at least 7 lb. for every gallon), citric acid, and terpene free citrus-skin oil (also a little fruit-flesh may be added). Concentrated fruit juices may be looked upon as special conserving process. These are prepared by concentrating the juice either in vacuum or through freezing. The former runs very quickly from the surface of thin layers and the heating which could become injurious to the juice is thereby avoided. At first a careful separation of the particles of the fruit flesh is necessary otherwise the concentrated juice would become too viscous and difficult to handle. The concentration through freezing (Kraus-process) depends upon the principle that when a solution is cooled below the freezing point of water a portion of the water of the solution is converted into pure ice

and the concentrated solution could be thus separated. This process is gone through repeatedly with special apparatus twice or thrice. In order to improve the staying power of the concentrate it is still necessary to increase the percentage of dry substances of the completed products by about 60-65 % with the addition of sugar.

For the preparation of the juices in smaller quantities for household uses or for local distribution the following method according to the *Revue Agricole de Reunione* may be employed. The fruits shall be invariably cleaned well with a horse hair brush in warm water (50-60°C.) before use and dried. The juice is obtained, in the citrus fruits, by cutting them into halves (rust-free steel knives) and pressing out the juice with a usual lemon press; in the case of the pineapple the skin and scales are removed and separated from the fibrous materials and cut into pieces in a purree mill (mashing mill). Filtration is not necessary. Sieving through a gauze is enough. The gauze should be boiled before use, for about 10 mins. The juice is filled into bottles with porcelain and rubber-ring fasteners (beer or lemonade bottles) which have been carefully cleaned and pasturised. In the latter the bottles are at first kept open in a water bath (naturally the water must not enter the bottle) and the temperature brought to 60°C. then the corks are put on and the bottles immersed in the water and temperature raised to 65-70°C. by adding hot water. They should remain here for about 20 minutes. After 24 hours, the pasturising must be repeated (65-70°C. for 20 mins). Care must be taken that the given temperature is reached in the interior of the bottle also. To determine this it is better to place a bottle filled with water along with them and the water temperature estimated. The highest temperature given should be under no circumstances exceeded.—*Troepnpflanzer* 42 (1939); 219.

EXTRACTS

Effect of Fertilization upon Quality of Sugarcane. By cane quality or "quality ratio" is meant the ratio of cane to sugar yield, or the number of tons of cane required to produce one ton of sugar

In order to see how fertilizers affected the quality ratio a compilation was made of all cooperative field experiments made in the Hawaiian Islands from 1930 to 1936, inclusive, which have been concerned with the determination of optimum amounts of nitrogen, phosphate, and potash. These experiments included 289 nitrogen, 300 phosphate, and 298 potash tests. The results are shown as relative quality ratios for all the islands in terms of averages.

Nitrogen.

Lb. N Applied	Quality Ratio (average 8·91)
50	8·79
100	8·77
150	8·84
200	8·89
250	8·99
300	9·03

Phosphate and Potash.

Lb. P_2O_5 or K_2O Applied	Phosphate (Average Q. R. 8·96)	Potash (Average Q. R. 9·18)
None	8·93	9·24
1—100	8·95	9·18
101—200	8·96	9·15
201—300	8·98	9·15
Over 300	8·98	9·19

In the light of these results it appears reasonable to conclude that increased applications of nitrogen fertilizer are apt to result in a cane growth that will have a poorer quality; however, under conditions existing in Hawaii there is lack of sufficient proof that juice quality has been affected to any great extent by the application of either phosphate or potash fertilizers. If in individual cases phosphate or potash seem to affect quality it will be well to look for an affiliated causal relationship. (*Facts about Sugar* 34 (1939): 34—35).

A Tip to Sugarcane Growers—Value of Dry Farming. A practical grower aims at vigorous and uniform germination of sugarcane setts. Experiments have shown that temperatures below 50°F. are injurious to germination. It is a mistake to plant the setts too deep in the soil. In the Bombay-Deccan, the favourite method is to irrigate the fields and press the setts down into the soil with the foot, after which two short period irrigations, every four or five days, are given. Except in soils newly brought under cultivation, these irrigations have been found to be superfluous and when dropped the rate of germination has accelerated by 80 per cent. Dry planting gives much better results. The setts are placed in position in the furrows with just sufficient dry soil to cover them. The furrows are then irrigated with a slow flow of water for the first three or four times of watering till the soil at the sides settles down, after which the system of normal irrigation is followed. This system gave 60 percent germination even with the unfavourable temperature of 1934 and under normal conditions gave 70 to 80 per cent. It has been conspicuously successful in soils with bad tilth (the so-called chopan) of the Bombay-Deccan. The presence of dry scale leaves on the buds of the sugarcane also affects germination. The difficulty can be overcome partly by rejecting setts with dry-scaled buds and partly by using sulphate of ammonia at the time of planting. Some varieties e. g., E. K.—28, possess a large number of dry-scaled buds and require such assistance. There has been some discussion as to whether a sett should contain one, two or three buds. The three-budded setts are the best, probably owing to the additional reserve material in the larger sett.

Chemical studies show that there is no correlation between the amount of glucose in the sett and germination, though there appears to be some correlation between germination and the easily available nitrogen in the sett. The main factor is the amount of water in the sett: hence the improved germination which results from soaking them in water or lime solution. Soaking is advantageous only in areas where irrigation is not in vogue; in irrigated areas, it does not appear to be necessary. (*Indian Information Series*, Vol. 5, No. 33, page 68).

Gleanings.

Pineapple Propagation. A new method in Sierra Leone. In March this year (1938), the writer attempted a new way of utilizing pineapple stems for propagation which has given very promising results. The stem was stripped, cleaned in the usual way and cut *longitudinally* instead of transversely, into quarter slices. Thus slices exposed a large outer bud bearing surface, each slice bearing its own reserve of food from the interior of the stem. The inner surface of the pith was then pared flat and the slices placed outersurface uppermost upon a nursery bed of well-forked soil and humus and pressed half-way into the soil. It was found that within a week, the stronger buds had swollen and in three weeks little plantlets, strong in character, had developed. As soon as these were large enough (4 to 8 weeks), the plantlets were cut away with a small piece of the parent slice, the suckers by that time having become well equipped with rootlets. These plantlets required further nursing until old enough for their permanent

place in the field. After the first crop of suckers was removed the slices were replaced in the nursery for the further development of plantlets.

Plants which are in an advanced stage of fruiting are unsuitable for propagation by this method. It has been found that the best time to cut the stem is, when the plant is fully grown and just about to flower; after that the rate of multiplication declines. During the rains, germination, although somewhat slower, is quite successful. Shade is unnecessary during the rains, but is advantageous during the dry months.

The slices may be soaked in permanganate of Potash as done in St Lucia, to prevent ants attacking them when placed in germination beds. They should not however, be covered over, but left exposed for the free development of buds. The preparation of the nursery presents no difficulty and is simply a well-forked soil with the incorporation of well-rotted humus of well decomposed cow manure. (*Tropical Agriculture* 16: 192).

Soil decomposition of a plant pathogen. Several fungi which attack plants from the soil disappear when the host is not grown for a certain period. S. D. Garret of Rothamsted Experimental Station, has made a study of this action with *Ophiobolus Graminis*, the fungus causing 'take all' disease of wheat (Ann. App Biol. 25, No. 4, 742; 1938). The fungus apparently disappears as a result of natural decomposition by other micro-organisms of the soil. It will remain alive indefinitely in air-dry soil, at low temperatures of 2—3°C. and under sterile conditions. Decay of *Ophiobolus* mycelium is quickest when conditions are such that the normal micro-flora of the soil is greatest. Addition to the soil of energy materials lacking nitrogen, such as glucose or starch, hastens the destruction of Mycelium, whilst dried blood with readily available nitrogen, has the opposite effect. Soil conditions which are least favourable for the parasitism of *O. graminis* may, in fact, best preserve the organism during the non-pathogenic phase. *Nature* CXLIII (1939): 526.)

Orange Oil. Oranges grow in abundance in the plains of the Punjab and their production is showing a steady increase. According to the figures supplied by the Marketing officer of the Department of Agriculture, the production during the year 1934—35, of two principal varieties of oranges, namely Malta and Sangtara, was 5,24,256 and 7,11,271 maunds respectively. Hitherto these oranges were mostly consumed in eating, but recently the production of orange squashes etc., has been started on a small scale in the Punjab The orange fruit is known to yield some other useful products as well, but these have not so far been extracted from it. The most important of them are orange oil and pectin; orange oil finds use in confectionery for flavouring as well as in perfumery and medicine. Pectin is used for the manufacture of food jellies. Local and foreign markets exist for both these products. With a view to study the possibilities for their production from the Punjab fruits, work was undertaken by the Department of Industries at its Industrial Research Laboratory in Shahdara. It has been found that the Punjab orange generally yields good quality orange oil and pectin. The preparation of pectin may be a little difficult matter, but orange oil from the peels can be extracted easily by the hand sponge process as used in Italy which consists of pressing the peels between the two fingers of the hand and receiving the oil in a sponge from which it is later on removed This method can be easily followed in Punjab homes by women-folk. The oil can also be recovered from peels by steam distillation in an ordinary distillation still. One and a half maunds of fresh peels yield by the latter method about one pound of oil at a total cost of Rs. 3—12—0. The local price of the oil is quoted at Rs. 5—0—0 per lb. Samples of the oil prepared in the Industrial Research Laboratory were sent to the various local dealers and consumers, all of whom have reported favourably about its quality. The industry is particularly suitable for firms which are engaged in

the preparation of orange squashes—one such manufacturer at Amritsar has already started the extraction of orange oil. Last season he prepared about 50 lbs. of oil the whole of which was consumed locally in the manufacture of soda water, fruit, and other essences. In those areas of the province specially the colonies, where orange peels can be collected easily and cheaply, the production of orange oil will be found to be a profitable industry. (*The Nagpur Agricultural College Magazine*, XIII, 4, 1939).

Iodine as an essential plant nutrient. Influence of iodine has been studied in water and soil cultures at Oregon Agricultural Experiment Station beginning in 1929. Crop indicators used in experiments include alfalfa, clover, peas, corn, lettuce, tomatoes and sunflowers. Mathematically significant increases in yield have been obtained, especially with alfalfa (lucerne), clover and lettuce, while germination has been stimulated with corn. Iodine seems to promote development of chlorophyll of green pigment in plants. Soil micro-organisms appear to be affected, particularly nitrogen-fixing legume root bacteria. Yeasts are known to be stimulated by iodine. Favourable concentration in flowing culture solutions is found to be one-fourth to one-half part per million. Flowing solutions were connected in series by Waldo Carlson, Graduate Assistant, who found the age of solutions affected stimulation and older solutions were more beneficial. The iodine may change to organic form before it is effective. With alfalfa in "sterile" culture this concentration was inhibitive, an indirect effect is indicated. James C. Lewis, Graduate Assistant, found stimulation from iodine in soil cultures using a soil well supplied as to total iodine. Two to four pounds of iodine as potassium iodide were found to be significantly stimulating in soil cultures with Aiken and Deschutes soil series. Other soils have given negative results. Even where increase in yield was small the iodine content of the plants has been increased manifold according to analyses by Mr. Lewis.

Comparison of methods for iodine determination has been made in the laboratory of Dr. J. R. Haag, Nutrition Chemist. Some improvement has been made in adopting the Harvey procedure for analysis of soil and plant materials.

Oregon soils, waters and plants are frequently low in iodine, yet certain deep wells, lakes and soils are found to be well supplied. Iodine in Oregon soils may run from ½ part to 15 parts per million. The iodine content of Oregon waters is from ·01 to 20 parts per million. The relation seems sharpest between iodine content of water and goiter. Soil iodine seems to accumulate with organic matter and to be higher in soils of sea-bed origin. Baumann in 1895 found absence of iodine in plants affects thyroid. Asd in 1903 recommended seaweed as fertilizer, due to its iodine content.

According to a map of the United States prepared by Dr. J. F. McClendon there is a high incidence of goiter in certain areas, including much of the Pacific Northwest. Head lettuce and spinach are among the plants that contain relatively more iodine. Marine by-product fertilizers afford a source of iodine. Small scale field trials are being made this season. If successful, potassium iodide might be added in irrigation water and large seed may absorb sufficient amounts for plant needs. (*Science* Vol. 89, No. 2315, May 1939. Pp. 434, 435).

Correspondence.

To

The Editor, Madras Agricultural Journal.

Sir,

A note on the use of cellophone for the use of posters and charts.

The ordinary cellophone paper which is more extensively used in view of its transparency for wrapping all commercial wares, is found to be a very good substitute for glass, in framing pictures and posters for exhibition purposes,

There is this added advantage—being a paper. the risk of breakage is totally eliminated. The cost is considerably low but it has all the advantage of glass, in giving a clear view of the contents inside.

The paper could be cut to any size and gummed back to the cardboard board, fixed in the reverse of the poster. This method which has been tried by me has been found to be quite good. It has been possible to protect the posters from the silver fish danger for a fairly long period. This method I venture to suggest could be substituted in place of others, for protecting the frames and posters against silver fish damage.

C. Jaganatha Rao.

Agricultural Jottings.

(From the Director of Agriculture, Madras.)

TIRUVOTTIYUR MILCH CATTLE MARKET

Market Report No. 6.

Madras, Friday the 11th August 1939.

Arrivals continue to be meagre. The quality of Ongole cows is rather poor. Country buffaloes of average and good classes are available. There was a brisk sale of Delhi buffaloes and the stock is diminishing. Generally an upward trend is noticeable in the price of buffaloes as compared to last week.

The following gives the stock movements during the week ending 10th August 1939.

	Stock at commencement.	Arrivals.	Sales.	Balance at the end.
Cows-Ongole	70	82	56	96
Buffaloes-country	204	130	111	223
Buffaloes-Delhi	38	24	52	10

Age.	Milk yield.	Prices From	Prices To
Prices :			
1. Cows-Ongole.			
1st and 2nd calving	2—3 Madras measures	100	120
	3—4 ,, ,,	no stock	
2nd and 3rd calving	2—3 ,, ,,	60	100
	3—4 ,, ,,	no stock	
2. Buffaloes-country.			
1st and 2nd calving	2—3 ,, ,,	80	100
	3—4 ,, ,,	110	130
2nd and 3rd calving	2—3 ,, ,,	60	80
	3—4 ,, ,,	80	100
3. Others.			
Buffaloes-Delhi		150	220

(1 Madras measure of milk=4 lb.)

Market Report No. 7.

Madras, Friday the 18th August 1939.

Arrivals of both cows and buffaloes have increased during the week. A few cows of Delhi, Scindhi and Cross breeds are also available. Better types of Ongole cows have now arrived. A slight decline is noticed in the prices of both cows and buffaloes due to increased arrivals.

The following gives the stock movements during week ending 17th August 1939.

	Stock at commencement.	Arrivals.	Sales.	Balance at end
Cows-Ongole	96	125	102	119
Cows-crossbred		not available		4
Cows-Delhi	...	...	...	2
Cows-Scindhi	...	22	...	2
Buffaloes-country	223	191	129	285
Do. Delhi	10	20	12	18

Prices :

Age.	Milk yield.	Prices ranging. From	To
		Rs.	Rs.
1. Cows-Ongole			
1st and 2nd calving	2—3 Madras measures.	90	110
	3—4 ,, ,,	110	130
2nd and 3rd calving	2—3 ,, ,,	60	90
	3—4 ,, ,,	90	100
2. Buffaloes-country			
1st and 2nd calving	2—3 ,, ,,	70	90
	3—4 ,, ,,	100	130
2nd and 3rd calving	2—3 ,, ,,	50	70
	3—4 ,, ,,	70	100
3. Others.			
Buffaloes-Delhi		150	200
Cows-Delhi		100	150
,, -Scindhi		100	150
,, -Crossbred		100	800

(1 Madras measure of milk = 4 lb.)

Market Report No. 8.

Madras, Friday the 25th August 1939.

Number of cows and country buffaloes that arrived was less than in the previous week. Sales of both country and Delhi buffaloes are on the increase. Prices show a slight increase in the case of buffaloes.

	Stock at commencement.	Arrivals.	Sale.	Balance at end.
Cows-Ongole	119	114	73	160
Buffaloes-country	285	138	160	263
Buffaloes-Delhi	18	40	34	24

Prices ;

Age.	Milk yield.	Prices ranging From	To
1. Cows-Ongole.			
1st and 2nd calving	2—3 Madras measures.	90	110
	3—4 ,, ,,	110	130
3rd and 4th calving	2—3 ,, ,,	60	90
	3—4 ,, ,,	90	100

Age.	Milk yield.	From	To
2. Buffaloes-country.			
1st and 2nd calving	2—3 ,, ,,	70	100
	3—4 ,, ,,	100	130
3rd and 4th calving	2—3 ,, ,,	60	80
	3—4 ,, ,,	80	110
3. Others.			
Buffaloes-Delhi		150	200
Cows crossbred		150	200

(1 Madras measure = 4 lb.)

Market Report No. 9.

Madras, Friday the 1st September 1939.

While the rrivals of country buffaloes were on the increase only a few of Delhi buffaloes arrived during the week. Sales of both cows and buffaloes were on the increase. Prices were generally steady.

The following gives the stock movements during the week ending 31st August 1939.

	Stock at commencement	Arrival.	Sale.	Balance at end.
Cows-Ongole	160	104	139	125
Buffaloes-country	263	162	220	205
Buffaloes-Delhi	24	5	17	12

Prices:

Age.	Milk yield.	Prices ranging From	To
1. Cows-Ongole.			
1st and 2nd calving	2—3 Madras measures	90	110
	3—4 ,, ,,	110	130
3rd and 4th calving	2—3 ,, ,,	60	90
	3—4 ,, ,,	90	100
2. Buffaloes-country.			
1st and 2nd calving	2—3 ,, ,,	70	100
	3—4 ,, ,,	100	130
3rd and 4th calving	2—3 ,, ,,	60	80
	3—4 ,, ,,	80	110
3. Others.			
Buffaloes-Delhi		150	200
Cows crossbred		150	200

(1 Madras measure of milk = 4 lb.)

Market Report No. 10.

Madras, Friday the 8th September 1939.

Arrivals of country buffaloes were heavy and those of Delhi buffaloes, nil, during the week, while the quality of country buffaloes is good, the Ongole cows available at the market are poor. The prices of both cows and buffaloes tend to decrease slightly.

The following gives the stock movements during the week ending 7th September 1939.

	Stock at commencement.	Arrivals.	Sales.	Balance at end.
Cows-Ongole	125	96	109	112
Buffaloes-country	205	236	149	292
Buffaloes-Delhi	12	...	5	7

Prices :

Age.	Milk yield.	Prices ranging From	To
1. Cows-Ongole.			
1st and 2nd calving	2—3 Madras measures	80	100
	3—4 ,, ,,	no stock	
3rd and 4th calving	2—3 ,, ,,	60	80
	3—4 ,, ,,	80	90
2. Buffaloes-country.			
1st and 2nd calving	2—3 ,, ,,	60	80
	3—4 ,, ,,	90	90
3rd and 4th calving	2—3 ,, ,,	55	75
	3—4 ,, ,,	75	100
3. Others.			
Buffaloes-Delhi		120	175
Cows-crossbred		150	200

(1 Madras measure of milk = 4 lb.)

Market Report No. 11.

Madras, Friday the 15th September 1939.

Arrivals of Ongole cows have increased while those of country buffaloes have fallen down. Delhi buffaloes are not being imported. Ongole cows of superior quality available now at the market has considerably improved. Prices are steady.

The following gives the stock movements during the week ended 14th September 1939.

	Stock at commencement.	Arrivals.	Sale.	Balance at end.
Cows-Ongole	112	116	52	176
Buffaloes-country	292	147	159	280
Buffaloes-Delhi	7	...	...	7

Prices:

Age.	Milk yield.	Prices ranging From	To
1. Cows-Ongole.			
1st and 2nd calving	2—3 Madras measures	80	100
	3—4 ,, ,,	100	130
3rd and 4th calving	2—3 ,, ,,	60	80
	3—4 ,, ,,	80	100
2. Buffaloes-country.			
1st and 2nd calving	2—3 ,, ,,	60	90
	3—4 ,, ,,	90	120
2nd and 3rd calving	2—3 ,, ,,	55	75
	3—4 ,, ,,	75	100
3. Others.			
Buffaloes-Delhi		120	150
Cows-crossbred		150	200

(1 Madras measure of milk = 4 lb.)

Crop and Trade Reports.

Statistics—Crop—Sugarcane—1938—Intermediate condition report. The sugarcane crop has been affected by drought to some extent in Kistna. Chingleput, South Arcot, Chittoor, North Arcot, Madura, Ramnad and Tinnevelly. The condition of the crop is satisfactory in the other districts of the Province and normal yield can be expected if the season continues to be favourable.

The wholesale price of jaggery per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 4th September 1939 was Rs. 9—14—0 in Adoni, Rs. 8—7—0 in Mangalore, Rs. 7—12—0 in Rajahmundry and Vellore, Rs. 7—9—0 in Vizagapatam, Rs. 7—6—0 in Cocanada and Chittoor, Rs. 7—4—0 in Salem, Rs. 6—12—0 in Cuddalore, Rs. 6—10—0 in Vizianagaram, Rs. 6—7—0 in Erode, Rs 6—3—0 in Trichinopoly, Rs, 6—0—0 in Bellary and Rs. 4—15—0 in Coimbatore. When compared with the prices published in the last report i. e., those which prevailed on 9th August 1939, these prices reveal a rise of approximately 13 per cent in Mangalore, 12 per cent in Vellore, 3 per cent in Vizagapatam, Trichinopoly and Chittoor and 2 per cent in Rajahmundry and a fall of approximately 6 per cent in Bellary, the prices remaining stationary at the other centres.

Subject: Statistics—1939-40—Cotton—Intermediate Forecast Report. *Last Year's Crop.* The yield of the second or summer pickings of the 1938-39 crop is estimated to be below normal.

Current Year's Crop. The main season for sowing is not yet over in most parts of the Province. Sowings of the crop are in progress in the Circars and the Deccan. The condition of the early sown crop is generally satisfactory in the Circars and not so satisfactory in the Deccan.

The average wholesale price of cotton lint per imperial maund of 82$\frac{2}{7}$ lb. as reported from important markets on 4th September 1939 was Rs. 14—5—0 for Cocanadas, Rs. 14—13—0 for red-northerns, Rs. 13—10—0 for white-northers, Rs. 12-13-0 for Westerns (mungari crop), Rs. 14-13-0 for Westerns (jowari crop). Rs. 23-5-0 for Coimbatore Cambodia, Rs. 21-0-0 for Southern Cambodia, Rs. 20-11-0 for Coimbatore Karunganni, Rs 19-2-0 for Tinnevelly Karunganni, Rs. 17-13-0 for Tinnevellies and Rs. 17-10-0 for Nadam cotton. When compared with the prices published in the last report i. e., those which prevailed on 7th August 1939, these prices reveal a fall of five percent in the case of Cocanadas, and two percent in the case of Coimbatore Cambodia, Tinnevelly-Karunganni and Tinnevellies and a rise of one percent in the case of Westerns (Mungari and jowari) and Southern Cambodia, the prices of Northerns (Red and white), Coimbatore-Karunganni and Nadam cotton remaining stationary or practically stationary.

Statistics—Cotton—1939—40—First forecast report. The average of the areas under cotton in the Madras Province during the five years ending 1937—38 has represented 9 9 per cent of the total area under cotton in India.

2. The area under cotton up to the 25th July 1939 is estimated at 149,000 acres. When compared with the area of 284,300 acres estimated for the corresponding period of last year, it reveals a decrease of 47·6 per cent.

3. *Central districts and South—Mainly Cambodia tract.*—The area in the Central districts and the South represents generally the last year's crop left on the ground for second pickings before the plants are removed in September in compliance with the provisions of the Pest Act. The area in these districts fell from 135,100 acres to 86,500 acres. The yield is expected to be generally below normal due to insufficient rains in July.

4. *Westerns tract.*—The area under Westerns fell from 95,600 acres to 28,400 acres, i.e., by 70·3 per cent owing mainly to the want of timely and sufficient rains. The crop has been damaged to some extent by an attack of red hairy caterpillar in parts of the taluks of Adoni and Siruguppa in the Bellary district.

5. *White and Red Northerns tract.*—The area under White and Red Northerns fell from 31,500 acres to 12,000 acres, i.e., by 1·9 per cent.

6. *Warangal and Red Northerns tract.*—The area under Warangal and Cocanadas cotton fell from 15.900 acres to 15,6000 acres, i.e., by 1 9 per cent.

7. The average wholesale price of cotton lint per imperial maund of 82-2/7 lb. as reported from important markets on 7th August 1939 was Rs. 15 for Cocanadas, Rs. 14--13—0 for Red Northerns, Rs. 13—10—0 for White Northerns, Rs. 12—11--0 for Westerns (mungari crop), Rs. 14—10—0 for Westerns (Jawari crop), Rs. 23—9—0 for Coimbatore Cambodia. Rs. 20—14—0 for Southern Cambodia, Rs. 20—12—0 for Coimbatore Karunganni, Rs. 19—8—0 for Tinnevelly Karunganni, Rs. 18—4—0 for Tinnevellies and Rs. 17—9—0 for Nadam cotton.

8. Figures by districts are given below :—

(Area in hundreds of acres, i e., 00 being omitted).

District and tract.	Estimate of the area sown up to the end of		Increase (+) or decrease (–) of the area in column (3) as compared with the area in column (2).
	July 1938	July 1939	
(1)	(2)	(3)	(4)
	Acs.	Acs.	Acs.
Chingleput	...	...	...
South Arcot	4,0	6,0	+ 2.0
Chittoor	...	...	...
North Arcot	3	2	– 1
Salem	29,0	14,0	– 15.0
Coimbatore	33,0	26,0	– 7,0
Trichinopoly (including Banganapalle) ...	12,5	5,0	– 7,5
Tanjore	...	...	...
Madura	34,0	17,0	– 17.0
Ramnad	10,0	7,0	– 3,0
Tinnevelly	12,0	11,0	– 1,0
Malabar	1	1	...
South Kanara...	2	2	...
Total, mainly Cambodias including Nadam and Bourbon	135,1	86,5	– 48,6
Kurnool (Pattikonda taluk)	15,5	3,0	– 12,5
Bellary	75,0	20,0	– 55,0
Anantapur	4,5	5,0	+ 5
Cuddapah	6	4	– 2
Total Westerns ...	95.6	28.4	– 67,2
Kurnool (excluding Pattikonda but including Banganapallee)	31,5	12,0	– 19,5
Total, White and Red Northerns ...	31 5	12,0	– 19,5

Vizagapatam (Golgonda taluk)	1,8	1,5	- 3
East Godavari	5	5	Nil
West Godavari	5	3	- 2
Kistna	1,0	1,2	+ 2
Guntur	12,0	12,0	Nil
Nellore	1	1	Nil
Total, Warangal and Cocanadas ...	15,9	15,6	- 3
Chinnapatti (Short-staple)	6,2	6,5	+ 3
Vizagapatam (except Golgonda taluk) ...			
Grand Total ...	284,3	149,0	- 135,3

Statistics—1939—Ginger crop—First forecast report. The area under ginger up to the 25th August 1939 in the Malabar district is estimated at 11,300 acres as in the previous year The condition of the crop is satisfactory.

Statisics—1939—Pepper—First forecast report. The area under pepper up to 25th August 1939 in the districts of Malabar and South Kanara is estimated at 102,300 acres (93,700 acres in Malabar and 8,600 acres in South Kanara) as against 103,400 acres (94,600 acres in Malabar and 8,800 acres in South Kanara) estimated for the corresponding period of the previous year. The yield is expected to be normal.

The wholesale price of pepper per imperial maund of 82, 2/7 lbs. as reported from important markets on 4th September 1939 was Rs. 11—6—0 at Calicut, Rs. 10—14—0 at Tellicherry and Rs. 11—0—0 at Mangalore. When compared with the prices which prevailed on the 9th January 1939 these prices reveal a fall of about 10 per cent in Mangalore and 4 per cent in Calicut and Tellicherry. (*From the Director of Industries and Commerce*).

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 8th September 1939 amounted to 406,498 bales of 400 lb. lint as against an estimate of 388,900 bales of the total crop of 1938-39. The receipts in the corresponding period of the previous year were 422,554 bales. 319,678 bales mainly of pressed cotton were received at spinning mills and 169,246 bales were exported by sea while 120,099 bales were imported by sea mainly from Karachi, Bombay and Egypt.

College News and Notes.

Students' Corner. Stud nts Club-Hostel Tatler—*The Hostel Tatler*—a magazine entirely managed by the students is under circulation among the various officers of the Agricultural College and Research Institute. The students are to be congratulated on the get up of this humorous publication, which reveals a wide range of talents in all directions.

Games *Cricket:—Rhondy Shield.* The Agricultural College A team played against the local Government Arts College on 26-8-39 at the College maidan. The Government College batting first were all out for 76. Kothandaraman, was deadly with his bowling—securing 8 wickets for 14 runs. The Agricultural College put up a huge total of 221 for 5 wickets, when stumps were drawn. Messrs. H. Shiva Rao and Mohiuddin the opening pair scored 41 and 51 respectively, and retired. S. V. Srinivasan scored 57 in quick time and was caught in the end. The other scorers wese Kothandaraman 10 not out and K. S. Ramaswami 29. The Agricultural college A team thus won the match.

On 27-8-39 the Agricultural College Cricket team visited Palghat and played against the Government Victoria College. Entering first the Agricultual College team scored 161 for 8 and declared. Mr. C. Ramaswami indulged in some hefty hitting and scored a brilliant 78 when he was caught. The Government Victoria College scored 65 for 8. (Kothandaraman 5 for 26, K. S. Ramaswami 3 for 15). The match ended in a draw.

A very exciting and interesting match was played on 7-9-39 between the Agricultural College and S. R. C. B. at Stanes grounds. The Agricultural College won the toss and allowed the S. R. C. B. to bat first. The S. R. C. B. were all out for 152 (Venkatachalam 35, Subbaraman 40, B. S. Krishnamurthy 23, S. V. Srinivasan 5 for 2, S. Kothandaraman 4 for 69).

Batting next the Agricultural College compiled a total of 222 for 8 and thus won the match. (C. Ramaswami scored 94 which included Eleven fours and one six. S. V. Srinivasan 43 and Mohiuddin 29.) Messrs. C. Ramaswami and S. V. Srinivasan are to be congratulated on their brilliant batting.

Foot-ball *Inter Collegiate match.* The College Eleven played the Voorhe's College (Vellore) Eleven on 1-8-39, at the College ground and won the match by 1—0. The only goal was scored by Hanumantha Rao. On the 15th September the College team played against the Local arts college on the latter's grounds and lost the match by 0—4. The disastrous result of the match was due to the inability of some players including the captain to participate in the game.

Hockey. *Inter collegiate contest.* The College XI played the Salem XI on 23-8-31 at the College grounds and won by a big margin of 6—0.

In the match played against Voorhes' College XI on 3-9-39 at our grounds the College XI won by 3--0.

The match between the College XI and the Government Arts college played on 9-9-39 was marred by an unfortunate incident. As no goal was scored in the full time, extension was granted, and in the first half of the extended time, the College XI scored 2 goals in quick succession. Another goal was scored in the second half and when the fourth goal was about to be shot, 2 minutes before the time, a melee of players ensued, inside the ring of the Government College goal. As game could not be resumed owing to the refusal of the Arts College players to continue, the umpire blew the whistle and declared the Agricultural College as winners.

Michaelmas Holidays. The September terminal examinations are over and the college is closed for students from 16-9-39 to 3-10-39. Some members of the Students' Club have left on a games tour to Tellichery, Cannanore and Mangalore on 15-9-39, and they are expected to participate in Tennis, Cricket and Hockey Matches.

Officers' Club The Annual Club Day will be celebrated on Saturday the 21st October 1939. The Club Day sports and tournaments are being conducted.

Personal. We are glad to learn that Mr. T. K. Thangavelu, A. D., Ooty has been awarded medal for his improved turmeric Polisher by the I. C. A. R.

Situations Vacant.

Messrs. Begg Sutherland and Company Limited, Cawnpore, has vacancies for a number of Assistant Sugarcane Entomologists to carry out work on pest control in their sugarcane areas in the United Provinces and Bihar.

The qualifications required are a good *Honours* Degree in Science, with Agriculture, Botany and Zoology as the principal subjects. A knowledge of Entomology is desirable and some acquaintance with statistical methods of field experiments. The work will mainly consist in the collection of field data and applying methods of pest control under direction, and it is desirable that candidates should have experience and a liking for this type of work. The salary on appointment will be Rs. 130 p. m. rising to Rs. 150, together with travelling allowance and free quarters. Successful candidates will be required to join the Company's Provident Fund. A knowledge of sugarcane pests is not essential, but what we want is a type of man who is young and keen, with a sound training in Scientific methods and a liking for this kind of work. Graduates who have just come down from the University will be considered, as well as those with some experience of post-graduate research. Applications should be forwarded with copies of testimonials.

Weather Review—AUGUST 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	3·1	-4·2	15·7
	Calingapatam	2·2	-4·7	13·5
	Vizagapatam	1·8	-3·6	11·7
	Anakapalli*	2·0	-3·4	10·1
	Samalkota*			
	Maruteru*	4·2	-3·3	13·1
	Cocanada	5·6	0·0	17·5
	Masulipatam	3·2	-3·5	11·8
	Guntur*	3·7	-1·6	11·6
Ceded Dists.	Kurnool	4·3	-0·9	9·3
	Nandyal*	0·0	0·0	0·0
	Hagari*	5·8	+2·6	10·5
	Siruguppa*	7·4	+3·9	11·9
	Bellary	3·2	+1·0	7·5
	Anantapur	4·8	+2·0	11·4
	Rentachintala	3·2	...	10·9
	Cuddapah	2·0	+3·8	8·1
	Anantharaju-pet*	1·0	-2·2	11·3
Carnatic	Nellore	1·0	-2·1	7·9
	Madras	0·8	-3·7	9·4
	Palur*	2·6	-2·2	16·4
	Tindivanam*	2·4	-3·5	12·5
	Cuddalore	3·9	-1·5	20·8
Central	Vellore	0·4	-5·4	12·0
	Salem	8·1	+1·6	25·6
	Coimbatore	2·2	+1·1	8·0
	Coimbatore A. C. & R. I.*	3·1	+1·9	8·8
	Trichinopoly	3·6	-0·3	18·2

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	1·0	-2·5	19·3
	Aduthurai*	3·9	+0·6	20·4
	Madura	3·2	-1·1	18·0
	Pamban	0·3	-0·4	8·6
	Koilpatti*	0·0	0·0	0·0
	Palamkottah	1·1	+0·6	6·1
West Coast	Trivandrum	6·6	+2·5	42·7
	Cochin	11·3	-1·0	96·8
	Calicut	15·3	0·0	93·3
	Pattambi*	15·3	+1·1	76·9
	Taliparamba*	14·9	-8·4	99·6
	Kasargode*	23·5	+0·3	104·0
	Nileshwar*	29·0	+4·2	100·9
	Mangalore	19·6	-3·6	99·1
Mysore and Coorg	Chitaldrug	8·8	+5·8	20·7
	Bangalore	3·5	-1·9	18·3
	Mysore	3·3	0·0	14·9
	Mercara	26·7	-1·2	79·5
Hills	Kodaikanal	6·4	-0·6	27·9
	Coonoor			
	Ootacamund*	8·8	+0·6	30·1
	Nanjanad*	8·7	+1·8	27·8

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette.

The monsoon was active throughout the month. It was vigorous in Bengal, strong in the central parts of the country and Hyderabad and generally active in the West Coast.

Four depressions in the Bay of Bengal were responsible for the widespread rainfall. Some locally heavy falls occurred in the Deccan and Central districts. Rainfall was in excess in the Ceded districts, parts of West, South and Central districts and in defect elsewhere.

Skies were moderately to heavily clouded in the Konkan, parts of Malabar, Mysore and parts of the Madras Presidency; and lightly to moderately clouded in the North Madras Coast and Madras Deccan. Humidity was in excess in Malabar, Konkan, and the Madras Deccan and in defect in South East Madras and North Madras Coast.

The maximum temperatures were above normal in North Madras Coast, Mysore and South East Madras and in defect elsewhere. Nellore and Cuddalore recorded the highest maximum of 108°F on the 9th.

Chief amounts of rainfall.

Mangalore	4·5"	...	6th.
Salem	6·9"	...	7th.
Chitaldrug	4·3"	...	10th.
Hagari	3·9"	...	10th.

Weather Report for Agricultural College and Research Institute Observatory.

Report No. 8/39.

Absolute maximum in shade	...	92·0°F
Absolute minimum in shade	...	66·5°F
Mean maximum in shade ...	...	86·6°F
Departure from normal ...	...	− 0·3°F
Mean minimum in shade ...	...	72·6°F
Departure from normal ...	...	+ 1·5°F
Total rainfall for the month	...	3·1"
Departure from normal ..	...	+ 1·9"
Heaviest fall in 24 hours ...	...	1·7" on the 11th.
Number of rainy days ...	...	6
Mean daily wind velocity ...	...	7 miles per hour.
Departure from normal ...	...	Nil.
Mean humidity at 8 hours ...	...	70·7%
Departure from normal ...	...	− 3·3%

Summary. Weather was slightly unsettled during the 2nd week of the month, but otherwise practically dry. A total rainfall of 3·1 inches was received during the month of which 1·7 inches were received on the 11th. The rainfall was in excess by 1·9". Skies were moderately to heavily clouded and the humidity was in large defect. The mean maximum temperature was very slightly below normal while the mean minimum was above normal. P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notifications.

Transfers.

Name of officers,	From	To
Sri R. Swami Rao,	Asst. D. A., Cuddalore,	Asst. D. A., Madras.
,, E. K. Nambiar,	Offg. Asst., D. A., Madura,	Gazetted Asst. to the Principal, Agri. College, Coimbatore.
,, M. Kanti Raj,	Asst. to the Principal, Agri. College. Coimbatore,	Junior Lecturer in Agriculture.
,, S. Kasinatha Iyer,	Temporary Bio-chemist, Coimbatore.	Offg. Asst. Agricultural Chemist, Coimbatore.
,, G. Ganapathy Iyer,	Offg. Asst. Agricultural Chemist, Coimbatore,	Asst. in Chemistry, Coimbatore.
,, Samuel Jobitha Raj,	Supdt. A. R. S., Pattambi,	Offg. Asst. D. A., Madura.

Subordinate Services.

Appointment.

Janab Muhammad Ali Sahib, Agricultural Demonstrator, Puthur, in III grade (new) is appointed as Upper Subordinate, Agricultural Section, I Grade (new) on Rs. 145 in the new revised scale of Rs. 145-15-2—190 with effect from 15th August 1939 in an existing vacancy.

Promotions.

The following substantive and provisionally substantive promotions of upper subordinates in the Agricultural section are ordered with effect from 15th August 1939:—

Substantive Promotions:—

Sri B. Shiva Rao, from II grade to I grade Rs. 250.

Messrs V. Ratnaji Rao, S. R Srinivasa Ayyangar and T. G. Anantarama Ayyar from III grade to II grade Rs. 225.

Messrs K. Avudainayagam Pillai, V. N. Subbanacharya and D. Panakala Rao, from IV grade to III grade Rs. 200.

Messrs S. Viravardaraju, V. K. Kunhunni Nambiar and K. P. Sankunni Menon. from V grade to IV grade Rs. 120-10—170.

Provisionally Substantive Promotions:—

Messrs A. Gopalan Nayar, M. P. Kunhikutti, and K. Govindan Nambiar from II grade to I grade Rs. 250.

Messrs D. Panakala Rao, A. Ramaswami Ayyar, M. A. Balakrishna Ayyar and V. T. Subbiah Mudaliar from III grade to II grade Rs. 225.

Transfers.

Name of officers	From	To
Sri M. Somayya,	F. M., A. R. S., Nandyal,	A. D, Yellamanachill.
„ M. Bhavani Shanker Rao,	Asst. in Oil Seeds,	A. R. S., Tindivanam.
„ V. S. Rangacharlu	A. D., Bellary,	F. M., A. R. S., Kodur
„ S. Dharmalingam Mudaliar,	Asst. in Paddy Section, Coimbatore,	Asst. in charge of A. R. S., Pattambi.
„ T. K. Balaji Rao,	Asst in Paddy, A. R. S., Aduturai,	Asst. in charge of A. R. S., Aduturai
„ M. B. Venkatanarasinga Rao,	Asst. in Paddy, A. R. S., Meruteru,	Asst. in charge of A. R. S., Maruteru
„ K. Hanumantha Rao,	Asst. in Oil Seeds, A, R. S., Kasargode,	A. R. S., Pattambi.
„ K. Saptharishi,	Asst. in Chemistry, Coimbatore,	A. R. S., Aduturai.
„ K. Bhushanam,	Offg. Asst. in Chemistry, Coimbatore,	A. R. S., Anakapalle.
„ P. Krishnamurthy.	F. M. A. R. S., Anakapalle,	A. D., under training Narasannapet.
„ N. H. V. Krishnamurthy,	F. M. Anakapalle,	Asst. in Paddy, A. R. S., Maruteru.
„ G. Sakharama Rao,	A. D., Udipi,	A. D., Moodubidri.
„ K. S. Ramanna Rai,	A. D., Moodubidri,	A. D., Udipi.
„ C. Raman Moosad,	A. D., Ponneri,	A. D., Manjeri.
Janab P. Abdulla Haji Sahib,	A. D., Manjeri,	A. D., Ponneri.
Sri M. P. Sankaran Nambiar,	A. D., Calicut,	A. D., Dharapuram.
„ N. K. Thomas,	A. D., Dharapuram,	A. D., Calicut.
„ A. P. Balakrishnan Nayar,	A. D., Tiruchengode,	A. D., Omalur.
„ P. M. Appaswami Pillai,	Asst. A. D., Omalur,	A. D., Attur.
„ N. Narayana Ayyar.	A. D., Attur,	A. D., Tiruchengode.
„ M. Suryanarayana Ayyar,	A. D. in Mycology in Cuddalore,	To undergo training in Entomology, Coimbatore.

,, C. Krishnamurthy,	Offg. Asst. Entomology under training,	A. R. S., Anakapalle.
,, B. M Pinto,	Offg. A. D, Hospet,	Asst. in Oilseeds, Kasargode.
,, Adiseshaiah,	Undergoing training at Gudiyatam,	A D., Vellore.
,, K. B. Vytheswaran,	A. D., Chengam,	A. D., Vellore.
,, N. Venkaiah,	A. D. under training (Kavali),	A. D, Kandakur.

Leave.

Name of officers.	Period of leave.
Sri Seshadri Ayyar, A. D., Perambalur,	L. a. p. for 3 months from the date of relief.
,, C. S. Balasubramaniam,	L. a. p. for 1 month from 11-7-39.
,, R. Krishnamurthy, A. R. S, Nandyal,	L. a. p. for 2 months for 12-8-39.
,, P. Israel, I. C. A. R., Asst. in Entomology, Coimbatore,	L. a. p. for 30 days from 4-9-39.
,, R. Govinda Ramaya, A. D. (on leave),	Extension of l. a. p. for 1 month from 21-8-39.
,, M. Jivan Rao, F. M., F. R. S., Kodur,	L. a. p. for 3½ months from 8-9-39.
K. M. Jocob. A. D. (on leave),	Extension of l. a. p. on m. c. for 4 months.
Sri C. Jagannatha Rao Asst. in Cotton, A. R. S., Nandyal,	Extension of l. a. p. for 20 days from 3-9-39.
,, P. Ramanadha Rao, A. D., Atmakur,	L. a. p. for 10 days from 17-8-39.
,, K. Krishnan, A. D (on leave),	L. a. p. for 2 months from 11-8-39.
,, M. Subba Reddy, A. D., Rayachoti,	L. a. p. for 2 months from 6-9-39.
,, K. S. Krishnamurthy Iyer, A. D, Trichinopoly,	L. a. p. for 1 month and 3 days from 28-8-39.
,, L. Krishnan, A. D,. Tanjore,	L. a. p. for 15 days from 8-9-39.
,, Rajagopala Ayyangar. Asst. in Chemistry, Coimbatore,	L. a. p. for 1 month from 6-9-39.
,, S. Madhava Rao, F. M., Horticulture, Central Farm, Coimbatore,	L. a. p. for 16 days from 31-8-39.
,, S. Mayandi Pillai, A. R. S., Nandyal,	L. a. p. for 2 months from 13-8-39.
,, C. S. Namasivayam Pillai, Asst.. A. D., Nanguneri,	L. a. p. for 20 days from 18-9-39.
,, G. Venkataratnam, A. D., Chodavaram,	L. a. p. for 25 days from 6-9-39.
,, A. P. Balakrishna Nayar, A. D., Tiruchendgode,	L a. p. for 2 months from 21-9-39.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during August 1939.

A. Books.

1. *Danish Agriculture : Its Economic Development.* Einar Jensen. (1937). 2. *A world Tour for the Study of Soil Erosion control methods.* Grasovsky, A. (1938). 3. *The Rape of the Earth : A World Survey of Soil Erosion.* Jacks, G. V. & Whyte, R. O. (1939). 4. *Calcium Superphosphate and Compound Fertilisers : Their Chemistry and Manufacture.* Parrish, P. & Ogilvie, A. (1939). 5. *Economics of Peasant Farming.* Warriner, D. (1939). 6 *Report on Systems of Agricultural Credit and Insurance (League of Nations Pubn).* Tardy, M. L. (1938). 7. *Report on the Cost of Production of Crops in principal sugarcane and cotton tracts in India—Vol. IX—Mysore, Hyderabad (Deccan) and Baroda.* I. C. A. R. Pub. (1939). 8. *Horticultural Colour Chart—(England Royal Horticultural Society Publication).* Wilson, R. F. (1938). 9. *The Science and Practice of Conservation: Grass and Forage Crops.* Watson, S. J. (1939). 10 *Elements of Dairying* Olson, T. M (1938). 11. *Short Courses in Colleges of Agriculture.* Kirkpatrick, E. L. (1938). 12. *An Introduction to Modern Genetics.* Waddington, C. H. (1939). 13. *Swedish Contributions to the Development of Plant Breeding.* Akerman, A. (1938). 14. *Structure and Composition of Foods : Vol IV—Sugar, Syrup, Honey, Tea, Coffee, Cocoa, Spices, etc.* Winton, A. L. & Winton, K. B. (1939). 15. *Fauna of British India Series—Protozoa : Sporozoa.* Bhatia, B. L. (1938). 16. *Fauna of British India Series—Mammalia—Vol. I, Primates and Carnivora.* Pocock, R. I. (1939). 17. *Fauna of British India Series—Butterflies—Vol. I.* Talbot, G. (1939) 18 *Statistical Methods for Research Workers—7th Edition—Revised.* Fisher, R. A. (1938).

B. Reports and other Publications.

1. Cochin Agricultural Department Annual Report, 1937-38. 2. Agricultural Marketing Adviser (India) Annual Report, 1937. 3. Central Board of Irrigation (India) Annual Report, 1937-38 4 Ceylon Coconut Research Scheme Annual Report for 1938. 5. England Imperial Bureau of Soil Science Annual Report for 1938-39. 6. Campden Fruit Research Station Annual Report, 1938. 7. Hawaii Agricultural Experiment Station Annual Report, 1938. 8. Rhodesia Agricultural Department Annual Report, 1938.

The Madras Agricultural Journal
(ORGAN OF THE M. A. S. UNION)

Vol. XXVII.] OCTOBER 1939 [No. 10

EDITORIAL

Plant Quarantine in India. Man's incessant thirst for travel and exchange of goods has aided the development of the world's communications. Oceans and mountain ranges which originally functioned as natural barriers against long-range travel and transport have ceased to be so, and along with the many benefits, the conquest of nature has brought in its train an evil—the involuntary introduction and spread of pests and diseases. Every civilized country in the world is alive to the dangers of such unwanted introductions. Quarantine ordinances are promulgated in these countries for not only preventing or limiting the introduction of pests and diseases but also to control or eradicate them. The legislation of each country provides for the examination of plants and plant products at sea-ports or other points of entry on its borders, and suitable methods of examination and disinfection are carried out by a plant protection service. As a further aid to such examination, the exporting countries are required to have their exports examined within the country of origin and certified. India has not been far behind other countries in enacting the required legislation. The Destructive Insects and Pests Act 1914 of the Government of India and similar legislations in the major provinces and states are instances in point. Amendments and additions to these are being made from time to time to comprehend new problems arising in a field of ever-increasing complexity. Yet, a cursory perusal of the existing all-India Act reveals that the Government of India have not kept pace with the requirements of modern knowledge on plant pests and diseases. To mention one point, clause 4 of the 1936 notification provides for the fumigation of all imports with hydrocyanic acid. We doubt whether this treatment is suitable for several fungous and virus diseases which India does not want. Taking for granted that cyanide fumigation will kill all insect pests, we doubt whether it should find universal application irrespective of the presence of insects. Researches in several countries have shown that different plant species cannot stand the same dose of cyanide and hence it looks apparent that the employment of a variety of accepted phytosanitary methods is called for. Again, while the examination and certification of Indian exports is a function of the Agricultural services of the country, the control of imports is in different hands. The limitations of an organisation which lacks adequate training and experience in phytopathological methods are obvious. It is not our purpose to formulate the proper organisation of the present system, but we hope that some of the points raised by us will receive the attention of the authorities.

The Present Position of *Pollu* Disease of Pepper in Malabar*

By K. M. THOMAS, B. A., M. Sc., D. I. C.,
AND
K. KRISHNA MENON, L. Ag.,
Agricultural Research Institute, Coimbatore.

Introduction. Pepper (*Piper nigrum*, L.) is a commodity in which India has for several years held a predominant place in the world's market. The west coast of India enjoyed a practical monopoly till the beginning of 19th century when there was keen competition from the Malay Archipelago.

It is a crop of great commercial importance to Madras Presidency since Madras has always taken a preponderating share of the trade in India in pepper as seen from the following table :

TABLE I. Distribution of the export trade in pepper among the various provinces in India from 1933-34—1937-38.

	Quantity in cwts.				
	1933-34	1934-35	1935-36	1936-37	1937-38
Madras	50,533	60,681	24,939	23,326	16,148
Bombay	7,766	12,715	910	1,158	683
Bengal	521	656	513	480	620
Sind	89	13	45	6	5
Burma	...	5	8	7	...

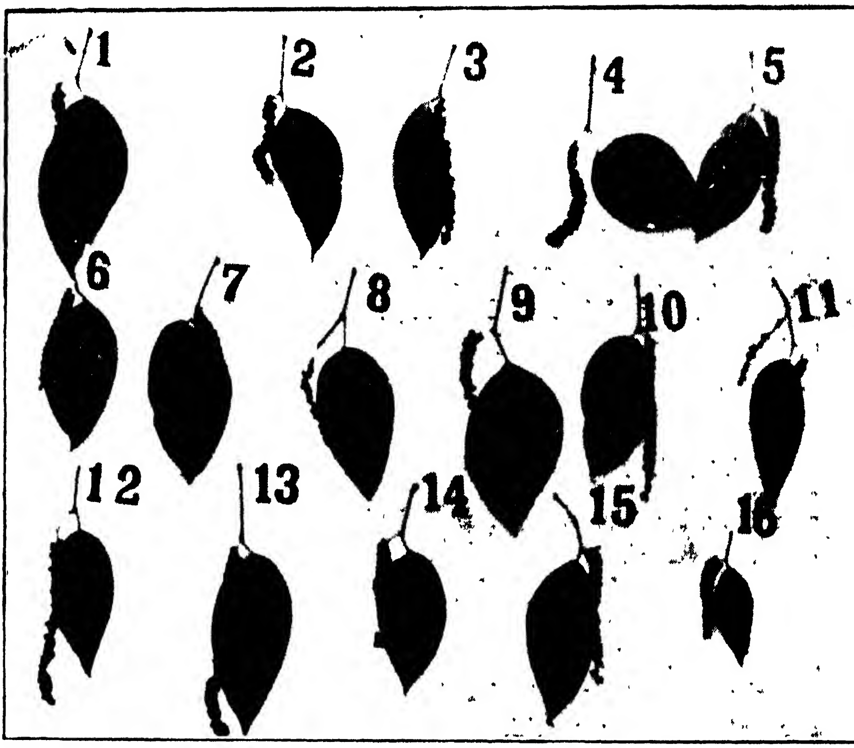
Area. It is extensively cultivated in and below the Western ghats. In Madras the principal producing areas are Malabar, Cochin, Travancore, Mysore, South Kanara and to a small extent Coorg. In Bombay the area under the crop is about 7,500 acres, practically the whole of which is in Kanara. In Bengal it is grown to a very limited extent.

Present depression. It is found that due to (1) world slump in prices and increasing competition from other countries and (2) diminished returns due to pests and diseases, India is losing her hold on the world's markets. The following statement shows the rapid shrinkage in the export of this commodity from India, though the acreage under the crop has either remained stationary or shown a slight increase.

TABLE II. Export of pepper from India and Madras, and the area under pepper in Madras.

Year.	Quantity in cwts.		Value in Rupees.		Area under pepper in Madras.
	India.	Madras.	India.	Madras.	
1933—34	58,909	50,533	18,23,903	14,54,464,	97,011
1934—35	74,070	60,681	24,50,390	18,87,594	95,745
1935—36	26,415	24,939	7,62,852	7,06,574	97,981
1936—37	24,977	23,326	6,08,850	5,64,340	103,924
1937—38	17,455	16,148	3,91,616	3 57,762	104,081

* Paper read at the M. A. S. U. Conference, July 1939.



SOME VARIETIES OF PEPPER

1. *Karuvalli*, bold climber and bearing in alternate years.
2. *Karuvilanchi*, hardy, medium climber, yearly bearing and allied to kalluvalli.
3. *Balamcotta*, bold climber and yearly bearing.
4. *Arikottanadan*, medium climber, yearly bearing and good yielder.
5. *Perukodi*, medium climber and yearly yielder.
6. *Kumbhakodi*, bold climber, yearly bearing and good yielder.
7. *Mundi*, medium climber and yearly bearing.
8. *Thulakodi*, medium climber, yearly bearing and good yielder.
9. *Munda*, medium climber and poor yielder.
10. *Kothanadan*, good climber, yearly bearing and heavy yielder.
11. *Cheriakaniakkadan*, good climber and good yielder.
12. *Valiakaniakkadan*, good climber and good yielder.
13. *Chumala*, bold climber and yearly yielder.
14. *Kalluvalli*, hardy, medium climber and good yielder
15. *Kuthiravali*, medium climber yearly bearing and good yielder.
16. *Karinthakara*, bold climber, and bearing in alternate years.

Slump in prices and foreign competition. From the following statement, it will be seen that Netherland Indies and British Malaya have increased their exports whereas the exports from India have considerably fallen compared to the average exports during 1927—31. It is evident the production in other countries has increased. This has naturally resulted in a slump in the prices.

TABLE III Annual export of pepper from some important producing countries.
(Quantity in metric tons) (6)

From	1927—31	1932	1933	1934	1935	1936	1937
Netherland Indies	27,791	35,852	44,330	48,495	58,747	78,399	31,265
British Malaya.	13,374	16,580	16,211	20,437	22,673	10,939	10,885
Java.	7,935	6,327	5,852	4,039	5,011	5,814	1,953
India.	6,735	2,902	3,045	3,343	2 846	722	1,215
Indo-China.	3,953	3,233	3,679	4,002	3,434	3,901	3,791
Sarawak.	1,430	4,295	3,314	4 765	1,766	2,053	2,209
Others.	19,856	29,525	38,478	44,456	53,736	72,585	29,312

Pests and diseases. Among the diseases of pepper *pollu* is the most important The Malayalam word pollu means a hollow thing. As applied to pepper it means hollow and light berries. In a wider sense the word is more often employed to denote the loss occasioned by the presence in varying quantities of the improperly developed or damaged berries of low commercial value in the harvested crop.

Loss due to pollu. The loss caused to pepper varies from year to year. In some years it is said to be as high as 50 per cent. of the marketable produce.

History of investigations. In 1918 the Government Entomologist made the first attempt at a scientific investigation. In a report (1) the authors discuss the several factors which contribute to the production of *pollu*. From 1923 onwards a combined investigation was made by the Government Entomologist and the Government Mycologist. Interim publications were made from time to time (2), (3), (4) & (5).

Causes of pollu. There are three causes of *pollu*, viz., (a) physiological, causes producing spike shedding, (b) insect attack--flea beetle and gall-fly and (c) fungus attack (*Colletotrichum* sp.)

(a) *Spike Shedding.* Of the three factors, spike shedding is the most important. This is characterised by shedding of apparently healthy spikes during the period of maturity. The berries collected from shed spikes being immature become very light and partially hollow on drying, the degree of lightness depending on the stage of maturity at which shedding occurs. Microscopic and cultural studies of shed spikes at different periods and from different vines failed to show evidence of fungus, insect or bacterial attack of the stalks of the large majority of spikes. The following table shows the relative importance of the loss caused by spike fall, fungus and insect attack at the Agricultural Research Station, Taliparamba in 1932.

TABLE IV. Relative importance of spike-fall, fungus and insect attack.

Variety of vine	Percentage of spike shedding	Percentage of berries lost by fungus attack	Percentage of berries lost by insect attack.
Balamcotta*	46·3	5 6	9·2
Kalluvalli*	37·9	6·1	13·7

* Average for 21 vines.

(*b*) *Insect pollu.* There are two insects which are responsible for the damage caused to berries. One is the flea beetle. *(Longitarsus nigripennis)* and the other a gall-fly. Of the two the latter is comparatively insignificant. The flea-beetle bites small shallow circular holes in the rind of the berry and lays eggs therein, after which it covers the eggs with its excreta. The eggs hatch in 5 to 8 days. The grubs burrow into the kernel and destroy the contents. They later enter neighbouring berries which are similarly hollowed out. A grub destroys about 3-4 berries. Some times the grub in biting its way from one berry to the next may eat into the stalk of the spike and in such cases the distal portion of the spike dries up and turns black and the berries beyond this spot turn black and do not ripen, although they remain attached to the spike almost throughout the season showing a pale dark colour, (2).

The loss from insect attack has been found to vary from 6 to 21 per cent. It may be stated in this connection that in some cases insect attacked berries are difficult to distinguish from fungus attacked berries.

(c) *Fungus pollu.* A fungus (*Colletotrichum* sp.) has been found to be responsible for causing shrinkage and drying up of individual berries and to a small extent for attack on the stalk of spikes. The fungus causes circular or irregular grey spots on the leaves. The acervuli of the fungus appear on the upper surface as small black dots arranged more or less in concentric rings. On the stem the attack begins at the tips and descends to a limited extent and in course of time the stem is killed. Young vines and tender runners from old ones die in this manner. In the case of old vines the attack commences from the region of branching and the fungus is found near the nodes of dead branches. The attack on the spikes and berries is more serious and results in loss of crop. Evidently the infection begins with the leaf and stem. Microscopic examination of the tender fallen spikes disclosed the presence of the fungus at the basal region in some. The spikes are generally found attacked at the place where they spring from the stem. The leaf axils from which the spikes come out are favourable places for the accumulation of water drops and fungus spores, washed down from the leaves. The spores that get lodged here germinate and enter into the tender spikes and grow inside. The fungus inside brings about the rotting of the tissue and causes the spikes to fall. Vines in shady and damp plots shed more than those in open places. The berries from the shed spikes when dried become hollow and light and the fructifications of the fungus appear on them in large numbers. The stalks of the spikes

also develop the same fungus. On individual berries the fungus attack is characterised by a dirty brown discoloration of the rind. It begins from the upper portion of the berry and extends downwards. Some attacked berries get cracked. Later on the berries shrink and fructifications of the fungus appear on them. The extent of loss by fungus has been found to vary from 4 to 13 per cent.

Spraying experiments. *The use of different spray mixtures.* During 1923 and 1924 spraying trials with different strengths of Bordeaux mixture, with different adhesives were done during the month of August, when the berries are well formed and these have been found to have controlled fungus and insect *pollu*. Trials with different strengths of the mixture show that the plants are able to stand a 2 per cent. mixture without any deleterious effect, while a weaker ½ per cent. mixture also is equally effective and at the same time economical. The three adhesives viz., resin, casein, and fish-oil-resin soap which were tried with Bordeaux mixture were found satisfactory. Addition of lead arsenate to Bordeaux mixture to check the flea beetle attack was found to be superfluous as Bordeaux mixture by itself acted as a repellent to the insect (3).

Relative merits of May and October sprayings. A second series of spraying experiments was conducted in 1926 to study this aspect. It was found that May spraying did not effectively control *pollu* while the October spraying was beneficial (4).

TABLE V. Statement showing the effect of May and October sprayings against *pollu* at the Agricultural Research Station, Taliparamba in 1926.

Period of spraying.	Percentage of *pollu* (insect and fungus).	Average for each treatment.
May	19·74	20 05
,,	20 35	
May and October	4·22	2 48
,,	0·75	
October	7 27	5 20
,,	3·13	
Control	32 95	23 07
,,	23 95	
,,	14·30	
,,	21·06	

Replications.	Sprayed in May only.	Sprayed in May and October.	Sprayed in October only.	Control (not sprayed).
1	19 74	4 22	7·27	32 95
2	20 35	0·75	3·13	23·95
3	...	...	...	14·30
4	...	...	...	21·06
Total for each treatment.	40 09	4·97	10·40	92·26
Grand total.	147·72			

Analysis of Variance.

Source of variation.	Sum of squares.	Degree of freedom.	Mean variance.
Between group means	816·48	3	272·16
Within groups error	194·12	6	32·35
Total sum of squares	1010·60	9	

$$F \text{ value} = \frac{272\cdot16}{32\cdot35} = 8\cdot41 \qquad d.f. \ 3 \text{ and } 6.$$

F value from Tables P = ·05 = 4·76
P = ·01 = 9·78

Therefore the effects of different treatments are significant.

1. May *plus* October, and October sprayings give definitely better results than May spraying or control.

2. The differences between May *plus* October, and October alone is far from being significant (i.e) a single spraying in October is as good as two sprayings comprising of one in May and again in October.

3. Single spraying in May is not significantly better than control (i.e.) no spraying.

Spraying and mealy bugs. In the course of the spraying experiments recorded above it was observed that while spraying in October checked insect and fungus pollu, the sprayed vines showed a conspicuous attack of mealy bugs during the subsequent dry weather (4). An experiment was laid out in 1926 to study the relationship between spraying and mealy bugs. Two series of vines viz. (a) *Infested with mealy bugs* and (b) *Free from mealy bugs*, were marked out during May, when mealy bugs flourish most. Each series was sub-divided into 4 groups as follows :

1. Sprayed in May alone.
2. Sprayed in May and October.
3. Sprayed in October alone.
4. Control (unsprayed).

With the advent of the hot weather in the following season (February and May) all the vines under experiment were examined for mealy bugs with the following results :

1. Vines sprayed in May were either free from bugs or the attack was mild.
2. Those sprayed in May and October or October alone showed heavy infestation of bugs.
3. Unsprayed vines were also free or had only traces of bugs here and there.

This experiment definitely proved that October spraying encourages the infestation of mealy bugs. This marks a phase in the investigations when October spraying was found advantageous in controlling *pollu* but it encouraged mealy bug infestation.

Further experiments were laid out in 1927 with a view to discover a means of controlling *pollu* without bringing any evil effects in its trail. These consisted of (1) spraying with mixtures other than Resin Bordeaux and (2) spraying with Resin Bordeaux to the spikes and upper surface of leaves only (mealy bugs occur only on the lower surface). Among mixtures other than Resin-Bordeaux, lime sulphur and Burgundy mixtures proved unsatisfactory (5). Bordeaux mixture again proved good as far as *pollu* was concerned From the view point of mealy bugs, it was found that both sprayed vines and the controls remained unaffected. This showed that mealy bug infestation is not an inevitable corollary to October spraying but it may occur in certain years only.

Varietal variation in pepper. Experiments were resumed in 1931 at the Agricultural Research Station, Taliparamba to study the incidence of spike fall, *pollu* and yield in relation to the two important varieties in cultivation there. The data obtained are tabulated in Table VI. When the above data were analysed it was found that spike fall is heavier in *Balamcotta* than in *Kalluvalli*. But the combined loss from insect and fungus

TABLE VI. Statement showing the percentages of spike fall and pollu and yield of individual vines.

Serial No of Vines	Plot 17. A Balamcotta — Percentage of Spike-fall	Plot 17. A Balamcotta — Percentage of Pollu	Plot 17. A Yield in tolas	Plot 18. Kalluvalli — Percentage of Spike-fall	Plot 18. Kalluvalli — Percentage of Pollu	Plot 18. Yield in tolas	Plot 61 Balamcotta — Percentage of Spike-fall	Plot 61 Balamcotta — Percentage of Pollu	Plot 61 Yield in tolas	Quarry plot Kalluvalli — Percentage of Spike. fall	Quarry plot Kalluvalli — Percentage of Pollu	Quarry plot Yield in tolas
1	63·1	20 5	78 75	62 9	16 0	84 25	58·5	24·0	69·75	65·5	50·8	9·50
2	65·7	15 3	78·75	55 2	14 2	102 00	43 8	21 0	52·25	72·4	44·2	17·00
3	61 0	18·4	116 50	35·8	16·5	157·75	70 9	25·5	42·75	76 5	40·3	40·25
4	70 0	18 3	59 75	59 8	19·6	88 00	35·3	30·4	140·50	61·6	36·2	19·50
5	48 1	15 5	83·25	43.9	15·6	127 25	42 4	18 6	196·50	62 6	36·8	17 50
6	40·3	15 5	97 25	32 2	15 0	56 50	45·3	21 8	129 00	39·6	26 5	45 00
7	39 4	14·5	128 75	38·6	16·1	92 00	56 0	24 3	56 00	55·9	30 5	51·50
8	45·6	12 6	124·50	20 0	21·1	164 25	64 0	25 0	42·75	67·3	35·7	45 50
9	40 0	12·5	132·50	21·5	17·6	131·00	43 7	21·0	117·50	76·4	31·1	25·00
10	33·1	11·1	151·75	29·5	20·8	186·00	73·9	30 2	42 00	25·5	27 0	111·75
11	36·2	10·3	103·00	30 4	24 2	199·75	47·9	19 7	131 00	51 9	27 0	39·00
12	41·2	16 0	115·50	22 8	19 6	112·00	53·0	21 5	99·50	37 2	26·5	86·00
13	40·1	15·7	101·50	31·0	19·8	97 75	66 7	27·7	52·00	62·9	32 5	21·50
14	55·6	12·7	50·25	35·2	25 0	41·25	65 1	30·2	78·75	54·7	34 2	25·25
15	37·4	12·9	53 00	41·3	21·0	45 50	34 0	20·2	189·50	43 0	31·2	75·00
16	16·0	13·5	91·75	23·2	21·0	115·50	49·9	28·0	72·25	45 6	31·3	64 75
17	35·5	14·3	113·00	32·0	23·5	74·75	33·7	19·4	92 25	80 9	47·2	12·00
18	60·4	19·4	49·50	47 8	22·6	115 00	54 0	18·3	116 00	68·7	42·2	27·75
19	45·2	17·0	89 50	38·4	20 7	101 75	59·3	29·0	46·50	49·7	23·5	61·00
20	37·9	10·6	120 25	52·2	23 8	57·00	55 8	22·2	64 00	50·6	31·9	62·50
21	60·1	14·7	60·25	42·6	27·6	80 50	64·4	31·8	98·50			

pollu is h[illegible] in *Kalluvalli* than in *Balamcotta*. At the same time it was observed [illegible] in the same variety of pepper (*Balamcotta*) spikefall and *pollu* were significantly heavier in one of the two experimental plots than in the other.

Results of analyses

Plot.	Variety.	n.	Average.	S D.	S E. of mean difference.	Remarks. (Significance P = ·01)
			Spike-fall.			
17 A.	Balamcotta	21	46·3	13·38	2·8119	Significant.
18	Kalluvalli.	21	37·9	12·37		
Quarry	Kalluvalli.	20	57·4	14·70	2·9583	Not significant
61	Balamcotta.	21	53·2	11·95		
17 A.	Balamcotta.	21	46·3	13·38	2·7681	Significant.
61	Balamcotta.	21	53·2	11·95		
Quarry.	Kalluvalli.	20	57·4	14·70	3·0005	Significant.
18	Kalluvalli.	21	37·9	12·37		
			Pollu			
17 A.	Balamcotta.	21	14·8	2·82	0·7068	Significant
18	Kalluvalli	21	20·1	3·61		
Quarry.	Kalluvalli.	20	34·33	7·60	1·3697	Significant.
61	Balamcotta.	21	24·30	4·38		
17 A.	Balamcotta	21	14·80	2·82	0·8038	Significant.
61	Balamcotta.	21	24·30	4·38		
Quarry.	Kalluvalli.	20	34·33	7·60	1·3140	Signi icant.
18	Kalluvalli.	21	20·10	3·61		
			Yield			
17 A.	Balamcotta.	21	95·20	29·6	7·6785	Not significant.
18	Kalluvalli	21	106·18	40·0		
Quarry.	Kalluvalli.	20	42·86	27·3	8·3800	Significant
61	Balamcotta.	21	91·87	46·2		
17 A.	Balamcotta.	21	95·20	29·6	8·4664	Not significant.
61	Balamcotta.	21	91·87	46·2		
Quarry.	Kalluvalli.	20	42·86	27·3	7·5630	Significant.
18	Kalluvalli.	21	106·18	40·0		

Remarks. (1) *Spike fall:* The variation of the percentage of spike fall from plant to plant within a plot is very high, probably indicating the possibility of getting at a vine with a very low spike fall. However, if we compare the vines of the different plots we find that the mean spike fall in plot 18 *(Kalluvalli)* is significantly less than in the plot 17 A *(Balamcotta)*. This is a varietal difference which could be taken advantage of in breeding a type with low shedding of the spikes. There is however no significant difference between quarry plot *(Kalluvalli)* and plot 61 *(Balamcotta)* with regard to spike fall, probably due to the difference in soil conditions.

(2) *Pollu.* Variation in this case is from 17 to 20 per cent. only. Variation within any plot is not very high. If the mean values are compared we find that *pollu* in plot 17 A *(Balamcotta)* is significantly less than in plot 18 *(Kalluvalli)*. Similarly in plot 61 *(Balamcotta) pollu* is significantly less than in quarry plot *(Kalluvalli)*. Here again there is a varietal difference.

(3) *Yield:* There is no significant difference in yield between the two varieties.

Proposed lines on which the investigation is to be continued. (1) *Study of varietal resistance.* From a perusal of the foregoing paras it is clear that *pollu* is the result of three factors, viz., spike-fall, insect attack and fungus damage. There is variation between the two varieties under trial. The most promising line of attack therefore appears to be the study of varietal resistance to these three factors. While North Malabar has only two important varieties under cultivation, viz., *Kalluvalli* and *Balamcotta*, there exists a rich collection of varieties in other parts of South India. For example, the State Pepper Farm in Koney, Travancore, has 16 distinct varieties of pepper [Vide Plate]. Besides showing a wide range of variation in such characters as period of flowering, duration, periodicity in bearing, yield, climbing habit, spike length, size of berries, packing of berries in individual spikes, &c , these varieties show different degrees of resistance to spike shedding and insect and fungus damage. A comparative study of all the cultivated and wild varieties in South India promises to be helpful in solving the *pollu* problem.

(2) *Hybridisation.* Apart from discovering existing varieties with certain desired qualities, the large number of varieties available both in India and outside may provide valuable material for evolving new varieties by hybridisation. Some wild types growing in South Indian forests show certain desirable qualities like hardness and very long spikes. Being a vegetatively propagated crop, the prospect of obtaining suitable types by simple hybridisation appears promising

(3) *Study of agronomic factors.* Besides varietal variation, our studies have also shown that in the same variety grown in different fields there was a significant variation in spike shedding as well as in insect and fungus damage. This observation suggests the necessity for agronomic studies such as (a) study of the root system in relation to soil texture (b) manurial requirements (c) influence of shade, (d) conservation of soil moisture and (e) adverse effects of soil erosion.

(4) *Further trials with insecticides and fungicides.* Studies in the past have indicated the possibilities of controlling insect and fungus damage by the use of fungicides. But the development of mealy bugs on sprayed vines in certain years proved to be a handicap in pursuing this method of control. With a larger range of insecticides and fungicides available to-day, it may be possible to get over this difficulty. It is therefore necessary to study this aspect afresh with a view to discover suitable sprays, right strengths, proper periods for treatments, etc., and to work out their economics.

Acknowledgments. Our thanks are due to Mr. K. R. Narayana Ayyar, Director of Agriculture, Travancore for the information regarding pepper varieties in Travancore and to successive Deputy Directors of Agriculture, Tellicherry, for the facilities rendered for conducting field experiments at the Agricultural Research Station, Taliparamba.

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Plantain in Madras Province and its Market.*

By LOUIS J. ROYAL

Coimbatore.

[A brief survey of the plantain crop in the Province of Madras and a method to market it in an orderly manner which would remunerate the grower and build up a major provincial trade.]

In India, Plantains (bananas) are found in every petty shop on the road side, hanging in bunches; looking green today and turning yellow on the morrow, soon transferred into a cluster of golden fruits. They are beautiful to look at and delicious to taste.

A story for its latin name. There is a hypothesis prevalent among many, ridiculous though, that the forbidden fruit in the garden of Eden was Plantain. The fine form and the rich yellow colour of the fruit greatly helped Satan to success in his attempt at tempting Eve. Hence the specific Latin name *paradisiaca*. The botanical name is *Musa paradisiaca*.

Food Values. In his fine work, 'Food and the Principles of Dietetics' Dr. Robert Hutchison describes a good food— "That only is to be adjudged a good food which contains an ample proportion of nutritive constituents, which is easily digested and absorbed and which can be obtained at a reasonable cost." Plantain is just that 'good food'.

A good food according to Mr. Eustace Miles must be as free as possible from stimulants and moreover, a good food for purposes of modern life, when everything tends towards over acidity and clogging must have certain cleansing properties. Plantain as a food contains all the above requirements.

Composition of Plantains. In an analysis of *Pachai Vazhai*, a common variety grown in South India, it has been noted that the fruit contains 2·14% of proteid, 21·8% sugar, 1% Fat, 1% mineral matter and the rest water. (Analytical Data).

*Paper read at the M. A. S. U. Conference, July 1939.

Composition percentages of fresh fruits. (Prof. Plimmer.)

Fresh fruit.	Waste.	Water.	A. S. H.	Fibre.	Protein.	Fat.	Carbo-hydrate (sugar)	Calories per lb.	Vitamin.
Plantain.	43·3	40·2	0·5	1·2	0 6	0·1	14 1	278	A B B_1 B_2 C D
Apple.	9·2	77·5	0·3	0·7	0·3	0 2	9·8	196	*to* * * * * *low
Grapes.	5·1	80·3	0·5	0·6	0·6	0·1	13·2	261	* * * * * to ** Juice Extract.
Orange.	15·1	65·1	0·4	0·3	0·6	0·1	6·6	137	** V. low.
Pears.	12·7	74·0	0·3	1·4	0·3	0·1	7·9	144	* *
Pineapple.	32 7	58·4	0·3	0·3	0 3	·0	7·5	145	** **

Medical Research Councils Special Report. Series No. 167.

* = Contains vitamin.
** = Good source.
*** = Rich source.
B = Complex water-soluble.
B_1 = Separately estimated.
B_2 = Separately estimated.
Blank = Not tested.

Nutritive value of Banana and other foods compared (Fawcet.)

	Banana.	Banana Flour.	Wheat Flour	Oat meal.	Potatoes.
Moisture.	75·50	11·10	14·10	8 9	78·3
Protein.	1·26	3·55	11·4	15·5	2·2
Fat.	·50	·83	1·0	10·1	·1
Carbo-hydrate.	21·70	81·80	75 0	54·8	18·4
Mineral Matters.	·76	2·23	1·7	4·0	1·0

Its use in medicine. Plantain has many medicinal properties. Its claim in the medical field as an aperient has long been established.

Sir H. M. Stanley in 'Darkest Africa' (ii p. 239) writes —**For infants, persons of delicate digestion, dyspeptics and those suffering from temporary derangements of the stomach, banana flour properly prepared would be of universal demand.'**

Civil Surgeon R. A. Parker M. D. in 'Dictionary of the Economic Products of India,' states:—**A combination of ripe banana, tamarind and common salt is most efficacious in dysentry both for the acute and chronic forms of the disease and seldom failed to effect a cure.'**

According to Civil Surgeon J. H. Thoronton B. A., M. D., 'The tender fruit is used for patients suffering from haemoptys's and diabetes.'

Cultivation in India. In India plantain or banana is cultivated in the north, on the banks of the rivers in Bengal. In Bombay it is grown as a garden crop. In Assam and Burma it is grown to augment the food supply of the people and so cultivation is common all over. In the Southern Provinces it is grown in all the districts without exception. It is

produced on all types of holdings from the small kitchen garden for home consumption to vast stretches on the commercial scale. Hence it is difficult to gather accurate data on plantain acreage, the extent of cultivation and yield.

In the season and crops report of the Madras Province for 37-38, it is stated that the acreage devoted for fruits, vegetables and root crops for that year was 691, 470 acres. The normal is 679, 470 acres. Of this area 24% which is 138, 480 acres was completely devoted to cultivation of plantains.

TABLE I. Plantain acreage in Madras and average yield in tons.

District.	Acreage normal.	Yield in tons. (normal)
Vizagapatam,	4,400	27,500
East Godavari,	5,250	32.812
West Godavari,	5,290	33,063
Kistna,	600	3,750
Guntur,	1,130	7,062
Kurnool,	400	2,500
Bellary,	840	5,250
Anantapur,	40	250
Cuddapah,	330	2 062
Nellore,	540	3 375
Chingelpet,	2,420	15,125
South Arcot,	1,720	10,750
Chittoor,	950	5,937
North Arcot,	990	6,187
Salem,	5,750	35,937
Coimbatore,	5,510	34,437
Trichinopoly,	9,350	58,437
Tanjore,	11,500	71,875
Madura,	16,500	103,125
Ramnad,	3,400	21,250
Tinnevelley,	7,640	47,750
Malabar,	53 400	333,750
South Canara,	3,490	21,812
The Nilgiris,	700	4,375

Plantain production in Madras Province. On a modest average of 700 plants per acre, it may be said to yield 6¼ tons weight of plantain fruits with an average weight of 20lbs per bunch. Based on the Commerce Director's report the yield for 37-38 should be 865, 500 tons. It is difficult to assess the value of production as there is no standard price for a perishable commodity. Plantain is sold at the rate per hundred fruits ranging from Rs. 3 the highest paid for the famous *Sengadali* variety to 4 as. paid for *Puvan*. Usually the prices centre between 6 to 12 annas per hundred. In the absence of proper data we may roughly fix it at 3½ crores of Rupees calculated at 6 as. per hundred.

Varieties cultivated in the province. There are about twelve commercially different varieties and some are popular throughout the Province. Jacob who has conducted a survey on Plantain cultivation in Madras reports 65 different varieties and some of them only useful for culinary purposes.

TABLE II. Commercially known varieties, where they are grown and their prices per hundred. Variable.

Name of Plantain.	Price per 100.	Where it is grown.
Ayranka Poovan,	12 annas,	Stray throughout the Southern portion of the Province
Anakomban.	8 annas,	Coimbatore and Nilgiris.
Chakrakeli,	Re. 1/8 as,	Circars and in East and West Godavari.
Kathali,	Re. 1/8 as,	Chiefly in Malabar.
Kali,	6 annas,	Malabar.
Kapur,	12 annas,	South Canara.
Karuvazhai,	6 annas,	Sirumalai Hills.
Kunnan,	6 annas,	Malabar.
Myndoli,	12 annas,	Cochin State.
Manoranjitham,	8 annas,	Trichy Dt. and Kulitalai.
Attu Naendran,	2 annas.	Malabar.
Nana Naendran,	12 annas,	,,
Pachai Vazhai,	10 annas,	Trichy, Gudiyattam, Chittoor, Coonoor and Kolakambai.
Puvan,	14 annas,	Southern parts of Province.
Puvan (Ney)	8 annas,	Malabar.
Pachai Nadan,	8 annas,	Southern parts of Province.
Payan,	12 annas,	Tanjore District.
Pae Kunnan,	8 annas,	Shevoroy Hills.
Rastali,	Re. 1,	All over the province and chiefly in Tanuku, Salem, Trichy, Malabar, Nilgiris and stray in Malabar.
Sengadali or Sevvalai,	Rs. 3,	Chinglepet, Simhachalam, Vizagapatam Nilgiris and Malabar.
Suganthi,	10 annas,	Bellary, Siruguppa, Adoni and Kampli.
Sirumalai,	10 annas,	Sirumalai Hills.
Then Kunnan,	6 annas,	Malabar.
Thattila Kunnan,	...	,,
Vannan,	...	,,

Markets and Marketing. Late in 1908, the U. S. Counsel at Calcutta wrote in his report 'It is claimed that vessels properly fitted up can reach the Liverpool market from Calcutta in 25 days and that several kinds of fruits, *especially the plantain*, can be laid down in Liverpool market to compete the West Indian Banana, which now monopolizes the English market. The East Indian banana, both yellow and red, grows abundantly throughout Southern Provinces and the supply could be made practically unlimited. The fruit is in India and needs a market and if enough money is raised to back the enterprise, it is believed that India can get her share of the banana trade of Europe and hold it." That was written in 1908. Since then many changes have taken place. The new Cochin Harbour is a boon to South Indian export trade. The distance has been cut. Faster steamers with cold storage fittings are available at comparatively low rates.

Conditions being so favourable and the prospects for trade development promising, one naturally expects a brisk internal trade if not foreign, but a survey of the present local trade reveals very depressing

conditions. In the Madras Province the only trade worth mentioning is in *Pachai Vazhai* exported from Trichinopoly. Dindigul sends *Sirumalai* and *Virupakshi* varieties chiefly to Madras and a few other districts.

No data for this little inland trade is available. The broker or commission agent plays an all important role. He buys from cultivators in rural areas and consigns them to fruit depots from where it is sold to the retail shops and to street hawkers.

No proper attention is being paid for the preservation of the fruit during storage and transit, with the result the cultivator is paid low; the broker taking the risk on consigning them to towns on the forward price basis. The retail dealers and vendors in town are not happy over a good margin of profit in the sales of such perishable products. The consumer often pays a high price due to this inefficient marketing.

In some large towns the two or three wholesalers visit the garden in the up country from time to time to purchase then and there or enter into an agreement with the producers in advance of the season, to buy up the produce at certain fixed rates.

The transport media they use for consigning the fruits to their town depots are usually bullock carts padded with hay that travel over night 20 miles and reach the town at dawn.

In Malabar, a brisk trade in fritters (fried plantain chips) is carried on but it is confined more to the local market. I have seen fritters usually selling out as soon as they are put in view on the stalls which is generally towards evening. The trade would increase if more hygenic methods are adopted and the fritters not exposed to the road-side dust. It is said that a little volume of this commodity is exported to places like Madras, Hyderabad and Bombay. Commission agency plays a major part in this little export trade also.

It can be safely pointed out that with the expansion of banana trade banana fritters will play an important role in the export trade.

The best varieties of the fruit are available, the supply of any variety could be made unlimited and it can be sold at competing prices in the western market. There is a good potential market. What next?

Markets & marketing. Competitive selling of one product in a market tends to weaken price levels in the long run. It usually means unnecessary expenses in canvassing, distribution and over-heads. Whereas coordination of sales efforts tends to better net realisations even if market prices remain unchanged. Efficient marketing is not what volume of sales are effected but what profit is attainable in the net turnover at the same time keeping the consumers' price at a reasonable level.

Plantain is a perishable article which has to be consumed within a limited period. It is not possible to sell perishable articles by skilful adjustments to local and seasonal demands like storing and releasing supplies at just the place and time when and where competitors have left a gap.

Naturally the position of plantain sellers would be stronger only when their number is small.

In that little trade that is carried on at present the middle man or commission agent who acts the role of marketer to the cultivator is alleged to play an indifferent role without caring much either for the producer or the consumer. The knowledge of his indifferent attitude and the money that he makes has a very heinous effect on the morale of the cultivator.

The consumer will take to more plantains only when the grade is of a superior quality. The cultivator will take to quality growing only when he is certain of being paid for his labours. He will take sufficient interest only when his interests are protected.

Cooperative marketi ıg—a possibility. In Plantain trade Co-operative marketing is the only system that incorporates these basic principles of orderly marketing of perishable goods.

The advantages of a cooperative marketing association are manifold. It would be possible then to gather together the products of many small growers and to market them at distant hubs (concentrated markets). The grading, packing and despatch could be better supervised by the organization's trade mark with a reliability for the standard of quality. Uniform grades in plantain are much more satisfactory to the consuming public than miscellaneous lots. The producer gets the full benefits of the advantages derived from large scale operations and favourable trade connections. He is protected from being exploited by unscrupulous petty dealers and middle-men who play the role at present. He is sure of an outlet for his crop. Underselling is avoided and sales are always at remunerative figures. Besides, market news are available through the organization. The organization would be able to place the fruit to much better advantage than could individual sellers or growers. The small grower and the large estate owner both would get equal beneficial results of expert salesmanship of the organization.

A cooperative organization would require the guidance of experts for its formation, development and maintenance. The government must be willing to back and promote the enterprise by subsidy in the initial stages.

This could develop in course of time to the formation of a central provincial Marketing Association through affiliating various district units. The District units will collect the fruits and meet the local demand. The central unit will occupy itself in controlling the distribution both inland and foreign. Publicity campaigns would be planned and executed by them and further they can work in co-operation with the Central Agricultural Research Department, for bettering the quality of growing etc.

Co-operative marketing organization. Once the decision is made on the main principles, immediate attention should be diverted to grouping the areas and locating depots for collection purposes.

Pooling the produce: The first stage in co-operative marketing is pool, ing the produce and grading them on the quality basis. For efficient collection work the provincial area must be divided into units based on the yield,

kind and quality of the fruits. This is simplified as mostly particular varieties are grown at particular places. In forming the centres, main attention should be paid to transport facilities and geographic factors. This is all the more necessary as rapidity in action is the key note in fruit marketing, from the time the fruit bunch is cut from the stalk in an up country plantation until it reaches the consumer's table. The collection depot of every sub-unit area must be located, easily accessible to all the cultivators in that sub-unit area. Harvesting should be carried out on a distributed time and season by all the cultivators in the area as far as possible on particular days of the week to simplify collection work. Regular visits of the collecting agent to these areas would give him knowledge of the probable successive harvests. The district unit is able to inform the central provincial organization about the quantity available in the market during the following week. Control of distribution is made easier and is carried out efficiently.

Marketing the fruits collected; Once all the produce of the unit area has arrived at the warehouses of the District centres, the next stage is *Dealer Marketing*, and consigning to provincials for forwardal to the places where needed and thus avoiding flooding at any one centre.

Marketing naturally divides itself into two main functions; *Dealer marketing* and *Consumer marketing*.

In Dealer marketing the problems encountered are 1. transport 2. freight rates 3. storage facilities and 4. the selection of intelligent and capable sellers.

The District unit's central depot must be located preferably close to the city market hub which would enable a close watch over the market trends and consumer reaction. At the same time the location of the depot must be easily accessible to all up country plantations However, with a little careful planning the collection area may be made to be in close proximity of the dealer marketing area thus forming a homogeneous market. Usually the best transport facilities available are easy to obtain at these hubs. Retail shop owners from the suburbs pay periodical visits to the citys' hubs and contact could be thus maintained with them. The cutting down of freight rates are effected by carefully choosing the transport media.

Consumer Marketing has only a consumer advertising problem to deal with. Advertising media in this country are few and they cover a vast area. Hence consumer areas cover wider areas and the whole province may be divided into three or four such consumer areas based on the language spoken, religious customs prevalent and geographic factors.

Transport. Transport is an important factor in the marketing of perishable commodities and hence careful attention should be paid to it. The media used for conveying the fruit from its stalk from an up country plantation to the consumers' table are said to be; human labour, bullock cart, motor lorries and some times rail.

The first stage is from the stalk to the collection depot. The Linlithgow Commission in their report p. 373 have observed, "The provision of

excellent main roads adequate in all respects for every form of transport is of little benefit to the cultivator if his access to them is hampered by the condition of the road which connects his village with them. What matters to him is the state of the road between his village and the main road and the market."

Conditions since then have not been bettered and so long as they are not improved the best transport media would be human labour. Jamaica has found donkeys more economical and efficient and if the South Indian would take to it, it should be the choice.

From the collection depot to the District main depot two transport media are available. Bullock carts and crude oil run lorries. Bullock carts travel over night 20 miles. Some collection depots might use bullock carts padded with hay if that is economical or lorries whichever is advantageous. The large planter should as far as possible deliver his produce straight at the District depot in his own lorries.

In long distance transport such as from the District depot to the Provincial or to another District main depot there are only two media available ; motor trucks and rail.

Both in motor transport and especially in rail transport as has been observed wastage might occur due to ripening process taking place on the way. Such ripening is very uneven (i. e.) they arrive at the destination in three conditions ; semi-ripe, over-ripe and boiled state. It is possible to prevent this by careful attention being paid when cutting the stalk at the proper time at the plantation.

The Bombay department of Agriculture which have conducted successful experiments on the keeping quality of the bananas recommend in their leaflet No. 6 of 1933 ; the immediate application of paraffin wax to the cut surface on the stalk. It would increase the keeping quality of the plantain fruits on the bunch. They further claim that this process keeps the fruit fresh for a longer period and that fruits do not drop from the stalk. Fruits get a good yellowish attractive color when ripe and no dark spots are formed. Rotting of fruits is appreciably checked. A pound of paraffin wax that costs four annas is sufficient to treat 100 bunches.

Rail transport. The problem encountered in rail transport are more numerous than in motor transport. Freight rates are heavy and properly ventilated vans are not available. The fruit usually arrives in boiled and semi-boiled state The fruit damaged in transfer is an unavoidable evil owing to two different gauges in the railway. And there is one more unpleasant fact to be pointed out namely pilfering of fruits, during transit. In the words of Messrs. Howard and Howard, in improvements in packing and transport of fruits In India,—(*Vide* Agricultural Journal of India, Vol 8, 1913.) ' The question of numerous thefts in transit, on the railways, remain to be mentioned. These cases are exceedingly numerous and they amount to nothing short of scandal.'

In these days of good roads — fast automobiles at low running costs, crude oil run motor lorries could be found to a much better advantage.

The co-operative organization. Regarding the entire organization it would comprise a central board, a provincial marketing board and various distrit units affiliated to the central board.

The distribution of work and personnel would be ;

Central Plantain Aid Board.

(Government of India aided-elected Council of growers and traders).

Provincial Marketing Organization.

Provincial unit.	District Unit.
Produce distribution. Dealer marketing. Transport. Allied export trade. Warehousing.	Collection and grading. Consumer marketing. Local transport. Fritters, figs and plantain. Flour manufacturing.
2	2
Market news bulletins. Publicity campaigns. Control of price. Research and Extension work.	Development, local sales campaign, growers club, campaign for better quality growing and demonstrations etc.
3	3
Co-operative Industry Aid Loan Bank.	Local Loan Bank.

The distribution department of the central organization would be controlling the allied industries of the Dt. units such as fritter products banana flour and figs The central organization that controls the distribution would be able to have first hand knowledge of local markets and also the foreign ones, thus best fitted to control the distribution.

The Agricultural Research department in co-operation with the central organization could introduce the latest crop improvements in plantain cultivation for improvements of quality and quantity.

Credit schemes. The formation of a co-operative bank run by the central organization would be more in the interests of the small growers. The system of controlled credit would be the proper method. The present lines on which the Cuddalore Co-operative Warehouse is operated might be introduced. In this case the bank's work is still minimised in that marketing is done by the organization and the District. Unit is closely supervising the cultivators' activities and the bank is an allied branch of the organization.

This is only a very brief survey. The organization should be planned out by experts of each particular branch. Another note could be added that such an organization cannot come into existence by itself. What is wanted is enterprise and co-operation from Government and leading planters.

Self-Help in Economic Farming.

By K. UNNIKRISHNA MENON,

Deputy Director of Agriculture.

Conservation of waste Materials. In the human system food is digested and the nourishment circulates in the form of blood. From certain glands products like bile are secreted and again used in the system for digesting food. If the removal of such products is delayed or stopped the blood gets impure and the system becomes unhealthy. If they are not properly stored and made available to get mixed with food in the digestive organs the digestion gets impaired and the system suffers from malnutrition. The position is somewhat similar with regard to a household and farm. If the waste materials of a household, cattle shed or farm-yard are not properly removed and stored in a regular manner, the place becomes insanitary. If they are not properly conserved and utilised as manure, the fertility of the soil suffers and results in poor crop yield. This upsets the economic position of the farmer and can be well compared to the anaemic condition of a bilious patient.

Making farming profitable. Many an educated man turns round and says that farming as such is not paying. Depending purely upon cultivation of crops makes some farmers indebted. The remedy for this state of affairs is also suggested by those people when they say that the farmer must take to some other ways of enriching himself. His debts must be cleared and he must be provided with funds for financing his cultivation better. Others suggest that the farmer must take to cottage industries and the profits from them should make up the deficit in farming. This is like the transfusion of blood to the anaemic patient unmindful of the fact that we have first to remove the fundamental cause of the economic anaemia or poverty from which the ordinary farmer is suffering. This transfusion of blood cannot go on for long. Therefore what is necessary before anything else is done, is to make farming profitable by all means and then let the farmer take to side lines of farming. One who advises the farmer to do it the other way about asks him to put the cart before the horse. If one part of the business does not pay, it is wise to ask him to stop that business and to take to something that pays. But this is not usually done. On the other hand, we are telling the poor farmer too many things that he should really get confused. Is it right to try all these various experiments on the poor and ignorant farmer before we take pains to go into the question as to why he is finding a deficit in farming? Any agricultural officer will be able to convince a ryot that he should conserve all his waste products as manure and use them to enrich his lands before he can make farming anything like a paying business. He agrees to this idea and determines to adopt the best ways of conserving manure. The moment the Demonstrator or the Demonstration maistry disappears, from the scene the farmer often goes back to his old system of wasting

manurial matter by his unthrifty ways of removal and conservation. He often pays for chemical manures and uses them while wasting his own resources of manurial wealth which he could have conserved and used as manure much cheaper, had he devoted a part of his attention to this subject in his every day life. Therefore in every rural uplift scheme the first item of work must consist in making the farmer devote his best attention to manure conservation so that all his manure wealth is available for use in his fields. Added to this he may grow green manure crops providing a very cheap method of increasing the supply of leaf manure to any field. Until these two items of work are adopted, other ways of improving the economic position of a farmer will all be hasty steps liable to break down. They may even divert his attention from the fundamental items of work he should do to improve himself. To my mind it looks that there is nothing more valuable in the possession of a farmer, than his own house-hold manure. It is more valuable to him than the land itself, because most lands if not adequately manured cannot give a profitable return. This fact will be clearly seen when an application of Re. 1/- in the form of manure will bring in an additional yield worth at least Rs. 2/- from a five months crop of paddy, granted that other conditions are the same in both the manured and unmanured fields. By adopting proper methods in collecting and preserving manure, a farmer can increase his manure supply at least five-fold and increase the crop yield considerably. Comparing Malabar and South Kanara, two districts under almost similar conditions of rainfall snd soil, one can easily see that the South Kanara ryot gets a comparatively higher yeild of paddy from a given area. South Kanara with its population of about 5 people per acre of paddy land under cultivation is able to export rice to Malabar which has less than 4 people depending on an acre of paddy land. Malabar has not only no surplus but has to import rice for her requirements. This is mainly due to the better system of manure conservation adopted (loose box system) in South Kanara and the leaf manure application given to every paddy land. The Malabar ryot allows his cattle manure to be wasted in various ways and neglects leaf manure application although he may have facilities for procuring the leaves needed and using them to the paddy lands.

To continue the analogy I employed earlier, the anaemic patient is also suffering from chronic consumption. By this I mean the large amount of undetected loss of manure and fertile soil that occurs from a given area by erosion. Erosion is rampant in all the dry lands. It has been found that even from the fairly flat black cotton soils under low rainfall the erosion amounts to 115 tons of the best soil a year. It is considerably more in more rainy and uneven areas. The water and the fine fertile soil that it carries away from the land are both of immense value to the farmer who knows little that he is losing such a large part of his wealth. In all possible cases effective methods must be adopted to stop or reduce the loss of rain water. This will automatically save for the soil what is carried away by rain water. The experience in our dry farming station has proved beyond doubt that the

evil effects of drought can be considerably prevented by putting small contour bunds in dry fields. The drought conditions in Coimbatore District this year have indicated that even in a 'dry' year better plants could be seen at the lower levels of fields near the bunds where rain water laden with silt could have stood and soaked in for some time.

Apart from all these, how the anaemic and consumptive patient has contracted a cancer of avoidable debts could be seen if we go deeper into the system of his working. He has to purchase work animals. The animals that he purchases surely deteriorate in value every year in such a way that a capital of Rs. 150 spent on a pair normally shrinks to about Rs. 60 in 3 years' time. Can he afford to allow such a heavy depreciation on his already slender resources ? He cannot This condition gets aggravated when a work animal dies from epidemics or from natural causes. He has to purchase an animal again and suffer the depreciation which follows. This is the cause of the accumulated debt from which the farmer patient is unable to recover. How to remedy this debt-cancer eating into his resources is the question. In answer to this comes the first stage when side lines of farming should be adopted. Every farmer must take to cow-keeping as a side line of his farming. A few milch cows should be available to supply him milk both for sale and for consumption. It pays him to grow fodder crops and feed both the cows and calves properly. This will assure him of a daily cash income by sale of milk and milk products. If the calves are properly fed they will form the future animals both for work and milk purposes. If the system is regularly adopted he increases his manure supply and can always be the owner of a few additional coppers every day enabling him to hold up his grains for sale at optimum prices.

Leaving this question aside for a moment we shall try to go into another question—going back to land. It is found that the credit usually available to an average tenant cultivator is low and he has to pay higher interest or profits to secure loans for his cultivation expenses. With this idea in view and for the very welfare of his own property a land owner has to take a living interest in his lands and cultivate at least a portion of them adopting the up-to-date improved methods. The investigations made by the Imperial Council of Agricultural Research recently have shown that in the garden lands of Coimbatore district a cultivating land owner can secure from Rs. 15 to Rs. 20 more per acre, than a non-cultivating land owner.

In the Vizagapatam district the owner cultivator gets a nett profit of Rs. 97 against Rs. 52 per acre of a non-cultivating owner from sugarcane and Rs. 22—8—0 and Rs. 20 respectively from paddy. In the Bellary district the figure shows an increase of Rs 5—8—0 per acre of dry land and 74—11—0 in case of wet land per acre in favour of the cultivating land-owner.

Therefore with all the defects that are inherent in the present methods of farming there is a certain amount of profit in farming, the more so when

the land-owner cultivates his own lands. This is certainly an information that should attract the educated young man who has land but goes to the town taking up an employment on a paltry monthly income leaving the land to be looked after by tenants and relatives who swallow the lion's share of the income. If people owning lands choose to spend their full energy on land adopting all the suitable improvements advocated by the Department, their income from lands can be considerably improved so as to enable them to secure better living wages in their own villages. For this purpose the educated man has to change his urban outlook and think in terms of his own relations in the village. If such a thing happens he can try to adopt side lines of farming such as fruit cultivation and preservation, bee-keeping, hand-spinning etc., to provide leisure time earnings for himself and his family.

Finally I would say that such people as have a liberal education and a broad rural outlook can serve as leaders in a village and adopt improved methods in preparing their produce for the market. Marketing as a separate question is now receiving special attention at the hands of Government in the direction of better pooling, cheaper transport, improvement of quality, grading etc. for the betterment of the farmer. For organising marketing properly in the villages the presence of educated farmers is absolutely necessary. It will be their duty to help the Marketing Section of this Department and the Co-operative Department by educating the villagers as to what best they must do to secure higher prices for their hard-earned produce. By the adoption of improvements in marketing methods at every stage we can secure better prices for the produce. Added to this a large part of the profits now shared by the middlemen can be diverted to the pockets of the producer himself making farming much more paying than at present. Thus agriculture can contribute its quota to the prosperity of the country.

A Note on *Vettiver* Cultivation.

By M. GOPALA CHETTY, L. Ag.

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Introduction. Vettiver (*Coleus sp.*) as the name indicates is a crop grown for its roots which possess a pleasant fragrance. In South India, ladies wear bits of the roots in the hair. The roots are also used for making garlands to decorate temple images.

Seasons and Soil. This crop is cultivated in all seasons and stays in the field from 3 to 4 months. The plants being delicate, require constant care, attention, and labour; and naturally the area which could be handled by an individual cultivator has to be limited to a few cents. Plantings have also to be so regulated as to yield a continuous supply to the market.

Since the roots are slender and grow to a yard's length and more, a deep sandy soil is very necessary for easy penetration of roots. The plants are bushy reaching a height of only $1\frac{1}{2}$ foot. The crop needs copious supply of water for good growth.

Cultivation. The crop is propagated vegetatively from stem cuttings which are planted on elevated beds of sandy soil 6" to 12" deep. Elongated beds of 2' width and convenient lengths of, say, 12 yards are made with interspaces of the same length and width. A cent of land will hold 3 beds of this size. The beds are dug well to the required depth and to each bed 2 or 3 baskets of farmyard manure and 4 lb. of groundnut cake are applied and well incorporated. The edges of the beds are raised all round to a width of 6" leaving one foot wide space in the middle for planting. Cuttings are taken from mature plants and planted in groups of five holes each. Each hole receives three cuttings. The five holes in a group are so spaced that there are four holes at the corners of a one foot square and the fifth one is at the centre of this square. The next group of holes is made 9" from the previous one and this process is continued until the whole length of the bed is planted. In a bed of 12 yards length, there would be thus 20 groups of holes for planting the cuttings.

The planted setts are pot watered daily until they strike root. Subsequently the beds are irrigated twice a week or oftener depending on the weather conditions. The spaces between the beds could be utilised as water channel from which water is splashed on to the beds with scoops. Where facilities for flow irrigation are lacking, hand watering can be pursued throughout. About 32 irrigations are necessary to bring the crop to maturity. The after cultivation consists of two hoeings at intervals of about 20 days.

Harvest. When the crop is ready for harvest the soil from the sides of the plants is carefully dug out and the sand from the exposed roots is washed out by a continuous stream of water. The plants with the roots

are released from the soil, and the green tops are cut off. The fibrous roots are ready for sale immediately.

The roots from six clumps fetch a rupee in the market, and there are 60 clumps in a cent of land which should therefore bring in a return of ten rupees. The expenses of cultivation amount to about five rupees leaving a profit of five rupees provided there is an easy market.

The details of cultivation are given below.

Cultivation charges for one cent of land.

		Rs.	as.
Digging the land and forming beds	...	0	4
Manure—½ cart load of farm yard manure	...	0	2
Groundnut cake—½ maund	...	0	6
Cost of one thousand setts	...	1	8
Planting the setts	...	0	4
Hoeings—two, at intervals of twenty days	...	0	4
Cost of 32 irrigations	...	1	0
Harvesting charges	...	0	12
Miscellaneous charges such as cost of pot etc.	...	0	8
		5	0
Price of produce from one cent of land	...	10	0
Net gain from one cent of land	...	5	0

SELECTED ARTICLE

The Influence of Manure on Potato.

(*Translated by N. Krishnaswamy*)

(Die Einfluz von Wachstumsbedingungen und Anbaumaznahmen auf Knollen und Starkeertrag sowie den Speisewert der Kartoffeln. Dr. Elsner-TrierenbergY *Die Ernahrung der Pflanze.* Heft 8, XXXV, 1939. p 238-241).

The potato plays an important role in the political and industrial economy, of a country. The yield and quality vary with climatic conditions. Still it is possible to neutralize these factors, by the employment of proper cultivation methods. That being so, the author feels that the knowledge of the many sided exchange relations between the individual growth factors on one hand and the yield and quality of the tubers on the other, is very important.

The 'Utilitarian value' depends upon the purpose to which the potato shall be put, whether it is used as animal feed, for industrial purposes (such as manufacture of alcohol, strach, flake etc.) or as human food. So far as commercial and industrial purposes are concerned, the primary object to be realised is a high total yield and the highest starch return per unit area. In the culinary potato the importance of the starch content more or less recedes to the back ground. On the other hand the properties of flavour, quality, colour, of the skin and pulp, consistency, cooking-qualities, the position of the eyes, the shape of the tuber etc. are particularly important.

Now and then protests are made by potato-consumers that through the use of the artificial manures a depreciation of the quality sets in, in particular the "typical and spicy aroma of the potato" becomes "soapy and stale". Careful experimentation on the flavour (on about 37 experiments) have however, brought no confirmatory evidence. They showed that even unusually high manuring with artificials gave only results which lay within the usual margin of error. No significant conclusions could be made out in this direction. Hence it is concluded that in potatoes meant purely for culinary purposes complete manuring is necessary, since it would in no way prejudice the flavour, while a reduction in manuring would only result in malformed smaller tubers and a lowering of the yield.

To supplement the above experiments certain manurial trials were conducted in which the manuring was rather one sided and from the stand point of accepted practice, completely incorrect. A permanent manurial experiment with the rotation rye—potato was made. In this potassium defeciency was found to have a very bad effect. The plots with 'No manure' and N + P gave only 20—25% the normal yield, because the plants showed the effects of the K defeciency, e.g. brown colouring of the leaves soon after sprouting and eventually became rotten and died. Flavour tests showed that the yields of plots without any K were worse than those with deficient N or P. The boiled potato was un-wholesome and greyish yellow in colour which by longer staying, became dirty yellow, whereas those from the standard plots retained their attractive colouration. It was also found that a heavy potash manuring brings about an even, natural light yellow colour on white tubers, which as a rule is preferred by the users.

The taste tests conducted on potatoes from lots which were strongly overmanured gave no significant indication of injury in reference to either P or K manuring singly. A little though practically insignificant, lowering of the flavour was found in plots manured with all the three principal ingredients together and also in one plot with N only.

From these experiments it follows that the belief that artificial manures spoil the flavour of culinary potatoes is groundless and that manuring, on the other hand, influences the taste less than the strain (variety) and soil constitution.

Besides climate and manure, the two last mentioned factors *viz.* variety and soil constitution, and various cultivation methods are of first rate importance in influencing the crop of potato. Particularly valuable is the practical application of the above mentioned possibilities to allow up to a certain point to make the yield independent of the climatic conditions which have an injurious effect on the quality. The correlation of some of these factors were worked out.

Within the various potato varieties a great amount of fluctuation was found with regard to yield and starch-content. In conformity with popular belief, leaf quantity in the first place,—though varietal to a certain extent,—and

long duration showed that the late potatoes gave the highest yields. On an average a fluctuation of about 8 percent was found in the starch content of the varieties. In 1926 the greatest differences were noted e. g. between *Fruhrose* (poorest in starch content-11·4 per cent.) and *Parnassia* (richest in starch - 21·3 per cent.) a difference of 9·9 %. But in the same season with in the same sort very significant differences in starch content (and of course yield also) up to 8·4 % were obtained. This was largely consequent upon external influences like faulty manuring, drought or early frost etc, which reduced the vegetative period, or to hailstorm, late blight, insect pests etc, injurious to the foliage which reduced the assimilation products. These disturbing influences were more apparent in the early than in the late variety. In general, it was noted that under ideal, favourable growth conditions the potato gives in the first place a high return of tubers while when any one of them fails owing to some cause or other, the starch content as such is increased.

No significant and regular correlation between the starch content from climatic conditions could be determined. There occurred only one exception, viz. the conditions of 'budding' and 'apical growth' of the tubers which are controlled by climatic conditions normally and towards the end of the rain period. The opinions on this point is rather contradictory. In general in the medium-early to medium-late varieties the newly formed tubers are richer in starch than the older ones. In the late varieties the condition is reserved, according to the degree of ripeness of the newly formed tubers. After all, the yield of the tuber and starch must be regarded, at the utmost, as dependent on the condition of the ripening and the degree of ripeness.

These points were made clearer through experiments. They showed that (in the variety *Parnassia*) with the rise in the yield of tubers the starch return also increased e. g. between flowering time and the ripening time it nearly doubled itself. This became clearer in the total yield of starch from 1·71 doppelzentner* per hectare ‡ (at flowering time) to 74·28 dz/ha (at ripening time) while the tubers yield for the same periods was 17·5 and 358·9 dz/ha and the starch content from 9·7% to 20·7%. It is very remarkable that the grade of ripeness is mainly dependent to a great extent on the length of the vegetative period. The yield of plants decreases both in very early and very late harvests. The shortening of the vegetative period through premature death of the aerial parts of the plant more or less through poverty of the nourishing materials, leads to a lessening of harvest yield, starch yield and starch content. From some of the permanent manurial experiments conducted, it was found that in plots which had no Potash, but had enough quantities of N and P, the potato plants died much earlier than those manured with K + P + N Potash defeciency leads also to shortening of the vegetative period and naturally to markedly low yield. The manures given were ammonium sulphate (100 Kg./ha. N.) superphosphate (70 Kg./ha. P_2O_5) and 40% K-manure salt (180 Kg./ha. K_2O).

1. ‡ One hectare = 2. 47 acres ; 2. * one doppelzentner = 1 quintal or 2 cwts.

A marked decrease of tubers yield and starch also were caused by certain diseases which caused detrioration e. g. leaf-roll (virus) disease. In the same way shading (as by mist or cloud) affects the crop causing reduction in the amount of sunlight required for starch formation.

Whereas the size of the seed-material, and the method of its preservation during winter, (stored whether in cellar or pits, with or without preservatives) gave no definite results, the yield differences, the choice of the strain and manuring showed greater influence. The average of 3 years results out of 32 manurial experiments including the stableyard manure also showed K-manure increased yield in all directions.

When artificial manures containing chlorides are applied there is a slight reduction in yield. In such conditions also, the N and P remaining constant increasing dozes of K (60, 120, 180, Kg/ha. K_2O as 40 % K-manure salt) showed that at least in light soils there is not much reduction in the yield. It followed also that fairly heavy doses of chlorides did not reduce the yield.

The results of a series of experiments on the influence of the same quantity of K manure at various periods of the life history of the potato plant (before sowing, after germination, before flowering) are given in the following table. These showed that a 200 Kg/ha. K_2O (at 40-50 % potash manure salt and first as K-sulphate and K-magnesia) increased not only the tuber yield but also the starch content.

Manuring per ha.	Average of 1928 to 1935. Yield of tubers dz/ha.	% Starch.	Yield of starch dz/ha.
Unmanured	186	18,3	34,1
$N+P_2O_5$	250	17,8	44,5
$N+P_2O_5+200$ Kg. K_2O of 40%K - salt			
1. before sowing	278	16,9	47,0
2. after germination	277	16,7	46,2
3. before flowering	267	17,0	45,4
$N+P_2O_5+200$ Kg. K_2O of 50% K - salt			
1. before sowing	285	17,0	48,4
2. after germination	287	16,8	48,2
3. before flowering	281	17,1	48,0
$N+P_2O_5+200$ Kg. K_2O K - sulphate			
1. before sowing	291	17,7	51,5
2. after germination	296	17,9	53,0
3. before flowering	279	17 9	50,0
$N+P_2O_5+200$ Kg,K_2O K - magnesia			
1. before sowing	287	17,8	51,1
2. after germination	285	17,8	50,7
3. before flowering	271	18,0	48,7

In this experiment all the plots were manured in all the years with a 80 Kg /ha of N. in the form of am. sulphate and 100 Kg./ha P_2O_5 as superphosphate. They showed very convincingly that 50 % of K-manure salt is still better than 40% and the addition of K-magnesia influences advantageously the starch content and the total yield of tubers and starch.

ABSTRACTS

Honey as a stimulant to the Rooting of Cuttings. During the last few years, a great deal of work has been carried on to show the effect of various synthetic substances "Phyto-hormones" on the rooting of cuttings. Experiments conducted at the Central Experimental Farm, Ottawa, Canada show that honey has a definitely stimulating effect on the rooting of cuttings of Chrysanthemum. It is said that this may be due to any one of the many substances in the honey, or to a combination of two or more of these. A 25 per cent. solution of honey, in water for 6 hours was used. (*Canadian Journal of Research*).

pH for Healthy growth in Citrus. As a result of the studies, recently made, it is concluded that citrus can grow under alkaline conditions. When the nitrogen is added to the solution in the form of calcium nitrate the active growth of citrus roots in such cases will reduce the degree of alkalinity. In certain types of alkaline soils, citrus root can change the pH about them so as to secure adequate nutrition; in other types of alkaline soils, the assistance of acid supplements may be needed. Depending on the stage of the absorption process, the roots may also increase the alkalinity The change in the solution brought about by the roots may not be of the pH best suited to healthy growth. Root-rot is often attributed to lack of aeration from one cause or another. In these experiments root rotting occured when the pH remained near 8·1, although an abundant air supply was run continuously through the culture solution. Vigour was quickly restored to such of the rooting roots as remained alive by the addition of sufficient acid to the culture. (A. R. C. H, *Imperial Bureau of Hort and Plantation Crop* Vol. VIII, No. 1 abstract in *Tropical Agriculture* Vol. XVI, No. 8, 1939).

EXTRACTS

Treatment of Citrus and Windbreak Trees affected with Iron Chlorosis. What appears to be a problem of increasing importance for many citrus growers in southern California is the so-called "lime induced" or iron chlorosis. The manifestation of this trouble—assumed to be a nutritional deficiency of iron—is the light yellow or white color of the leaves, the veins retaining the normal green color for a longer time. A general decline of the tree follows, and there is dying back of the branches, culminating in the death of the tree after several years.

While this is not a new disease in agriculture, nor is it new in a few limited areas of central and southern California; it is only in the last three or four years that it has advanced to any extent into some of the citrus orchards located in good, deep, valley soils. Dr. J. P. Bennett of the college of agriculture, University of California, after studying the disease in Santa Clara county, where it threatened the deciduous fruit industries, developed a standard treatment for trees based upon the injection of soluble iron salts into the trees. It has long been a recognized fact that plantings made on the highly calcareous soils of many of the upper bench lands would develop the symptoms of lime induced chlorosis; and that such soils should not be used. But our problem of dealing with the chlorosis in older orchards which have been planted on good soils and which have been healthy and vigorous for 20 to 30 years is another matter. From the standpoint of maintaining a permanent citrus culture in southern California, the advance of this disease offers a subject for scientific investigation to find

out what is happening in our soils that is throwing the nutrition of the trees "out of balance". For the moment it appears that we must deal with the disease in an emergency to preserve the health and productivity of the trees until the solution to the real problem is found for removing the cause. Dr. David Appleman, plant physiologist in the staff of the college of Agriculture at U. C. L A., having been closely associated with Dr. Bennett in the past, has, since September 1936, aided in a study of the problem as it has been developing in citrus, avocados, bluegum windbreak trees and other plants. He has helped with test plot treatments which have been based largely upon the methods outlined by Dr. Bennett. Many iron compounds have been compared, also studies have been made in the relative responses to treatments made in different seasons of the year.

Injections of ferric citrate—a soluble iron salt—into the trunks or branches of the trees have produced in some cases rather startling responses in the correction of the disease. The method consists of boring holes with a twist auger, using a $\frac{3}{8}''$ bit, halfway into the trunk or branch ; then filling the holes with the dry iron salt. The material is packed in by means of a special "gun". Sufficient space is left in the hole to insert a cork stopper or a dry wood dowel cut to fit snugly in the hole. Some asphaltum base wound paint is used to finish the job. The number of holes required depends upon the size of the tree For the eucalyptus tree, the number recommended is one hole for each two inches of diameter. The holes are spaced about equal distance apart around the trunk, going in a spiral beginning about six or eight inches above the ground. While findings are not complete it is indicated that it may be more effective to treat the old citrus tree by individual main branches rather than the trunk. Trunk injections on young citrus, bluegums, sycamores, and pines have been very effective. Avocados and older citrus have manifested responses in varying degrees to the treatment, but thus far the results are not as encouraging as with the other species named.

For best results of this treatment, the time or season of the year is important. It should be done just prior to or at the start of a flush of growth. Treatments made between March and August have been more effective and have shown less tendency to bark injury around the injections than those made in the period from September on through the fall and winter.

The length of time in which the trees will remain healthy after such treatment has not yet been determined. Some of the trials are now in the third year and are holding satisfactorily. The treatments in deciduous orchards which were established by Dr. Bennett have held for three to six years, and longer.

In treatment of young trees and shallow rooted plants, where the injection method cannot be used, it is necessary to treat the soil. Based upon experiments on young lemon trees and eucalyptus trees three months to one year old, we have maintained a satisfactory growth by applying iron sulphate to the soil. This was done by dissolving one-half pound of ferrous sulphate (copperas) in a bucket of water and pouring the solution into the soil basin around the tree. This may be repeated through the year as frequently as necessary. watching the foliage for return of the symptom ; in some instances the copperas applications were made about every six to eight weeks during the first year. After the trees had grown to a size where the injection method was possible, the ferric citrate treatment was made. *The California Citrograph*, 24: (1939) 89.

A Blight Resistant Chestnut. Several years ago the Bureau of Plant introduction of the U. S. Department of Agriculture brought in shipments of the Chinese

chestnut *Castania mollissima* in an effort to find a variety that would be resistant to the chestnut blight which worked such havoc in the chestnut area of the United States that practically every American chestnut has been destroyed. Crosses of one or more of these chestnuts were sent to the Bartlett Tree Research Laboratories, and among them was one which has grown for 20 years and has fruited for several years. The nut, too, is similar to that of the American chestnut in size, quality, and sweetness. Mr. Bartlett early recognized its merits and has distributed more than a thousand one-year-old seedlings to commercial nut growers in different sections of the United States. Because of the service rendered by Mr. Bartlett in co-operating with federal agencies in the distribution of this promising cross, the chestnut has been named by government workers the Bartlett chestnut.

In some instances, our native chestnuts have sprouted for a few years, and some have even fruited but then succumbed to the blight so that it does not appear likely that a disease-resistant native chestnut will grow again in the areas originally affected by the blight. (*Scientific American*, Vol. 161, No. 2).

Vitamin Alphabet going out of Style. The vitamin alphabet, that is, designation of the various vitamins by letter, is going out of style. For example, if you want to be really up-to-day, you must learn to say ascorbic acid instead of vitamin C when you are referring to the substance in orange juice (or other citrus fruits, tomatoes, and other vegetables) which prevents and cures scurvy.

This may be discouraging, especially if you pride yourself on having really learned the vitamin alphabet, or most of it But the scientists who have most to say about vitamins—the nutritionists and biochemists—are trying their best to get the vitamins out of the alphabet. They make the point that the letters did very well for names in the early days of vitamin discoveries when only a few were known and not much was known about them Now, however, since there are about as many vitamins as letters of the alphabet, with half-a-dozen going under the name of B, it is confusing and even leads to inaccuracy to call these essential food factors by letter.

Some of the vitamins have been identified chemically and even made synthetically. They have regular names, just as other chemicals have. Vitamin C is ascorbic acid. Thiamin is the beriberi preventing and curing substance that once went under the name of vitamin B or B_1 Nicotinic acid, the stuff that is curing pellagra, is the chemical that was variously called vitamin B_2, vitamin G and the P—P or pellagra preventing factor. Riboflavin is another diet-essential that was once labelled vitamin B or vitamin G. Recent discoveries have shown that it is necessary for the health of both man and other animals.

The anti-sterility vitamin, formerly called E, is now known as alpha tocopherol. Vitamins A and D may keep their letter names for sometime, because there is not so much confusion about them as about the B vitamins. Until the chemical composition of other vitamins is discovered, however, scientists favor calling them by descriptive names, not by letters. (*Scientific American*, Vol. 161, No. 2)

Seedless Watermelons. Seedless watermelons have been produced by treating the unpollinated flowers with napthalene acetic acid. The melons were all seedless but varied in shape Some, however, were normal in shape and size. The texture of these fruits was firm and solid. No difference in flavor could be detected from normally pollinated fruits. The work on these fruits is being done by Cheong-yin Wong at Michigan State College. (*Scientific American*, Vol. 161 No. 2.)

Citrus canker eradication. More than 25,000,000 abandoned and escaped citrus trees in Texas and Louisiana have been destroyed in the past four years in the

citrus canker eradication work of the U. S. Bureau of Entomology and Plant Quarantine. These trees were largely abandoned nursery plantings and seedlings spread from such plantings. Citrus canker is believed to be eradicated from the principal commercial citrus producing sections. (*The Californian Citrograph.* Vol. 24, No 10, pp 360).

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Sir,

Agricultural Propaganda.

Suggestions have been made in the pages of this Journal for improving the methods in agricultural propaganda. Among these, the gramaphone and the cinema carry a special appeal to popular fancy. If the object is merely to gather a large audience, the gramaphone or even some kind of vocal music will be enough. The cinema, of course, has become popular even in remote villages, and is the best means of securing a huge gathering. But for the purposes of successful agricultural propaganda this alone is not enough. It is but just the beginning. The chief object in any novel method of agricultural propaganda is to make the cultivating public understand, appreciate, and criticise the several items of agricultural improvement for which propaganda is sought.

It has been suggested for example to put topics of agricultural interest in story form or film versions in story form Neither is found to have lasting effect. It is possible, say to put "clean picking in Cotton" in a song form devoid of dry unromantic science in a tune favourite with the public say "*Suno Suno Ban Ki Prane*" and commit it to the care of a popular music star: say, Kokilagana Subbalakshmi But the interest of the people will linger longer in the melody than in the matter. It is only a cultural few that can appreciate meaning in a song. The majority of the cultivating class know no music more appealing than the music of the plough.

Again in regard to the cinema, stories of agricultural interest are apt to lose their effect on the audience unless they are of a telling and appealing nature. This is not possible without the aid of exaggerated romance and adventure. Agricultural topics can have least claim to these effects. They are prosaic and matter of fact. Also efforts at keeping up the element of interest while handling a scientific subject will have the inevitable tendency of side tracking from the essential fact to the non-essential romance, with the result the man who sees the picture thinks more of the fun in the story and ignores the useful part of it by laughing away for a while.

Nevertheless, the cinema abounds with possibilities. The animated cartoon version suggested editorially in a recent issue of the journal is a very valuable method. But it is bound to be costly, not to speak of want of talents like Walter Disney. It is suggested here that agricultural films should be in the form of travelogues. Films like Frank Bucks "Bring em back alive" have no less interest than films of enacted stories.

It should be possible for agricultural experts to sit together and devise a comprehensive agricultural scheme which can be put in the form of a travelogue news reel. To keep up interest the film can with a degree of discrimination be interluded with folk songs, comic village scenes and dances in appropriate sequence.

A Union Member.

Crop and Trade Reports.

Statistics—Crop—Sugarcane—1939—Second report The average of the areas under sugarcane in the Madras Province during the five years ending 1937—38 has represented 2·8 per cent of the total area under sugarcane in India.

The area planted with sugarcane up to the 25th September 1939, is estimated at 122, 740 acres When compared with the area of 90 800 acres estimated for the corresponding period of the previous year, it reveals an increase of 35·2 per cent.

The increase in area is general and is attributed to favourable prices prevailing for Jaggery. The increase is marked in Vizagapatam (plus 4,800 acres), East Godavari (plus 1,500 acres) Bellary (plus 4,800 acres), Anantapur (plus 1,000 acres), South Arcot (plus 4,800 acres) and the Central districts (plus 13,300 acres).

The condition of the crop is generally satisfactory. The seasonal factor for the Province as a whole works out to 98 per cent of the normal and on this basis, the total yield for the Province is estimated at 343,120 tons of jaggery as against 256,050 tons for the corresponding period of last year.

The wholesale price of jaggery per imperial maund of 82 2/7 (equivalent to 3,200 tolas) as reported from important markets on 9th October 1939 was Rs. 9—14—0 in Adoni Rs 8—15—0 in Vizagapatam. Rs 8—4—0 in Rajamundry and Chittoor, Rs. 7—14—0 in Vellore, Rs 7—7—0 in Cuddalore and Salem, Rs. 7—6—0 in Cocanada, Rs 6—10—0 in Vizagapatam Rs. 6—9—0 in Erode, Rs. 6—7—0 in Trichinopoly Rs. 6—6—0 in Bellary Rs 6—4—0 in Mangalore and Rs. 4—14—0 in Coimbatore. When compared with the prices published in the last report, i. e, those which prevailed on 4th September 1939, these prices reveal a rise of approximately 18 per cent. in Vizagapatam, 12 per cent. in Chittoor, 10 per cent. in Cuddalore, 6 per cent. in Rajahmundry and Bellary. 4 per cent. in Trichinopoly. 3 per cent in Salem and 2 per cent. in Vellore and Erode and a fall of approximately 26 per cent. in Mangalore and 1 per cent in Coimbatore, the prices remaining stationary in Vizianagaram, Cocanada and Adoni.

Statistics—Paddy—1939-40—First forecast report. The average of the areas under paddy in the Madras Province durings the five years ending 1937-38 has represented 13·4 per cent of the total area under paddy in India.

The area sown with paddy up to the 25th September 1939 is estimated at 5,469,000 acres. When compared with the area of 6,377,000 acres estimated for the corresponding period of last year, it reveals a decrease of 14·2 per cent.

The estimated area is the same as that of last year in the Nilgiris, a slight increase in area is revealed in the districts of East Godavari, Kistna, Guntur, Kurnool, Bellary and South Kanara but this is more than counterbalanced by a decrease in area in the other districts. The decrease is marked in the Carnatic (-429,000 acres), North Arcot (-115,000 acres) and Tanjore (-90,000 acres) and is reported to be due mainly to failure of rains at sowing time in the South-West monsoon period.

The first crop of paddy is being harvested in parts of the districts of East Godavari, Chittoor, Trichinopoly, Tanjore, Malabar and South Kanara. The yield is expected to be normal in East Godavari and on the West coast and below normal in the other districts. The condition of the standing crop is generally fair.

The wholesale price of paddy, second sort, per imperial maund of 82⅞ lb. as reported from important markets on 9th October 1939 was Rs. 3—0—0 in Madura, Rs. 2—14—0 in Vellore, Rs. 2—13—0 in Trichinopoly, Rs. 2—12—0 in Chittoor,

Rs. 2—11—0 in Virudhunagar, Rs. 2—10—0 in Vizianagaram, Rs. 2—9—0 in Rajahmundry, Ellore, and Bezwada, Rs. 2—8—0 in Cocanada, Masulipatam, Guntur, Kumbakonam and Tinnevelly, Rs 2—5—0 in Hindupur, Conjeevaram and Negapatam and Rs. 2—0—0 in Anantapur. When compared with the prices published in the last report, i. e., those which prevailed on 6th February 1939, the prices reveal a rise of about 26 per cent. in Madura, 25 per cent. in Kumbakonam, 23 per cent. in Negapatam, 22 per cent. in Trichinopoly, 21 per cent in Vellore, 18 per cent. in Cocanada, 14 per cent. in Ellore and Bezwada, 12 per cent. in Hindupur and Conjeeveram 11 per cent in Vizianagaram, Rajahmundry, Masulipatam and Guntur and 5 per cent. in Virudhunagar and a fall of about 5 per cent. in Tinnevelly, the prices remaining stationary in Anantapur and Chittoor.

Statistics—Crop—Gingelly—1939-40—Second Report. The average of the areas under gingelly in the Madras Province, during the five years ending 1937-38 has represented 15 6 per cent of the total area under gingelly in India.

The area sown with gingelly up to the 25th September 1939 is estimated at 525 400 acres. When compared with the area of 517,500 acres estimated for the corresponding period of last year, it reveals an increase of 1·5 per cent.

The estimated area is the same as that of last year in Tanjore and South Kanara ; an increase in area is revealed in Anantapur, Chingleput, South Arcot, North Arcot, Salem, Coimbatore, Ramnad and Malabar and it is partly counterbalanced by a decrease in area in other districts The variations are marked in Vizagapatam (-20,000 acres), East Godavari (-23,000 acres), West Godavari (-19,000 acres), Chingleput (plus 17,500 acres), North Arcot (plus 25,000 acres), Salem (plus 43 000 acres), Coimbatore (plus 10,000 acres) and Trichinopoly (-19,000 acres).

The early crop of gingelly has been harvested in parts. The yield was generally below normal due to unfavourable season except in South Arcot and Trichinopoly where it was reported to be normal.

The wholesale price of gingelly per imperial maund of 82⅞ lb. (equivalent to 3,200 tolas) as reported from important markets on 9th October 1939 was Rs. 6-10-0 in Vizagapatam, Rs. 6—8—0 in Vizianagaram and Cocanada, Rs. 6—6—0 in Trichinopoly and Tinnevelly, Rs. 5—15—0 in Rajahmundry and Tuticorin, Rs. 5 -11—0 in Ellore, Rs. 5—7—0 in Salem and Rs. 5—6—0 in Cuddalore. When compared with the prices published in the last report i. e, those which prevailed on 7th August 1939, these prices reveal a rise of approximately 21 per cent. in Salem, 17 per cent. in Trichinopoly. 13 per cent. in Vizagapatam 8 per cent. in Vizianagaram and 2 per cent in Tinnevelly and a fall of 7 per cent in Rajahmundry, 5 per cent. in Cuddalore, 4 per cent. in Ellore and 1 per cent. in Tuticrin, the price remaining stationary in Cocanada.

Statistics—Crop—Groundnut—1939—Third forecast report. The average of the areas under groundnut in the Madras Province during the five years ending 1937-38 has represented 50·1 per cent. of the total area under groundnut in India.

The area sown with groundnut up to 25th September 1939 is estimated at 2,863,200 acres. When compared with the area of 3,198.400 acres estimated for the corresponding period of the previous year, it reveals a decrease of 10·5 per cent.

A slight increase in area is reported from the districts of Vizagapatam, East Godavari, Bellary, Anantapur and Malabar but this is more than counterbalanced by a decrease in area in the other districts The decrease is marked in South Arcot (-120,000 acres), the Central districts (-167,000 acres) and Madura (-51,000 acres) and is reported to be due mainly to want of rain sat sowing time.

The summer crop throughout has been harvested. The yields were generally below the normal except in Anantapur and Cuddapah where they were estimated to be normal. The yield of the early crop is reported to be below the normal in Salem and Coimbatore.

The condition of the main crop is reported to be generally satisfactory outside North Arcot and Salem where the crop is said to have been affected to some extent by hairy caterpillar.

The wholesale price of groundnut (shelled) per Imperial maund of 82⅟ lb. (equivalent to 3,200 tolas) as reported from important markets on 9th October 1939 was Rs. 5 in Cuddalore, Rs. 4-14-0 in Vizagapatam, Rs 4-12-0 in Vizianagaram, Rs. 4-8-0 in Guntur, Rs 4-3-0 in Anantapur, Rs. 4-2-0 in Hindupur, Rs. 4-1-0 in Adoni, Rs. 4 in Nandyal, Rs 3-15-0 in Coimbatore, Rs. 3-14-0 in Bellary and Cuddapah. When compared with the prices published in the last report i. e., those which prevailed on 7th August 1939, these prices reveal a rise of approximately 12 per cent in Anantapur, 8 per cent. in Adoni, 7 per cent. in Vizagapatam 6 per cent. in Vizianagaram, Guntur and Hindupur and a fall of approximately 7 per cent. in Cuddapah, the prices remaining stationary in Nandyal, Bellary and Cuddalore. *(From the Director of Industries and Commerce.)*

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 13th October 1939 amounted to 434,832 bales of 400 lb. lint as against an estimate of 388,900 bales of the total crop of 1938-39. The receipts in the corresponding period of the previous year were 458,443 bales. 348,186 bales mainly of pressed cotton were received at spinning mills and 172,210 bales were exported by sea while 123,963 bales were imported by sea mainly from Karachi and Bombay. *(From the Director of Agriculture.)*

Agricultural Jottings.

(From the Director of Agriculture, Madras.)

TIRUVOTTIYUR MILCH CATTLE MARKET

Market Report No. 12.

Madras, Friday the 22nd September 1939

Ongoles have gone down both in quantity and quality while good type country buffaloes have arrived in larger numbers. The market is steady though Delhi buffaloes are in poor demand. Prices remain steady.

The following gives the stock movements and prices during the week ended 21st September 1939.

	Stock at commencement.	Arrivals.	Sales.	Balance at the end.
Cows-Ongole	176	66	69	173
Buffaloes-country	280	183	211	252
Buffaloes-Delhi	7	8	4	11

Age.	Milk yield.	Prices from	Prices to
Cows-Ongole.		Rs.	Rs.
1st and 2nd calving	2-3 Madras measures	no stock	
	3-4 ,, ,,	100	130
3rd and 4th calving	2-3 ,, ,,	60	80
	3-4 ,, ,,	80	100

	Milk yield.			From	To
Buffaloes-country.					
1st and 2nd calving	2—3	„	„	60	90
	3—4	„	„	90	120
3rd and 4th calving	2—3	„	„	55	75
	3—4	„	„	75	100
Others.					
Buffaloes-Delhi				130	200
Cows-Cross-Bred				150	200

Market Report No. 13.

Madras, Friday the 29th September 1939.

Arrivals of cows and buffaloes were low and the stock of Ongole cows available at the market continues to be poor. Though there has been a fall in the prices of both cows and buffaloes, buyers are not active. The Delhi buffaloes are not being imported.

The following gives the stock movements and prices during the week ended 21st, 29th September 1939.

	Stock at commencement.	Arrivals.	Sales.	Balance at the end.
Cows-Ongole	173	68	107	134
Buffaloes-country	252	124	146	230
Buffaloes-Delhi	11		2	9

Age.	Milk yield.			Prices From	To
Cows-Ongole				Rs.	Rs.
1st and 2nd calving	2—3	Madras	measures	70	90
	3—4	„	„	no stock	
3rd and 4th calving	2—3	„	„	55	70
	3—4	„	„	70	90
Buffaloes-country.					
1st and 2nd calving	2—3	„	„	60	90
	3—4	„	„	90	110
3rd and 4th calving	2—3	„	„	55	70
	3—4	„	„	70	90
Others.					
Buffaloes-Delhi				120	200
Cows-Cross-bred				150	200

Market Report No. 14.

Madras, Friday the 6th October 1939.

Arrivals of both cows and buffaloes continue to be low. The prices are steady at the low level reached last week. The market is very dull.

The following gives the stock movements and prices during the week ended 6th October 1939.

	Stock at commencement.	Arrivals.	Sales.	Balance at the end.
Cows-Ongole	134	83	77	140
Buffaloes-country	230	110	120	220
Buffaloes-Delhi	9			9

Age.	Milk yield.	Prices From	To
Cows-Ongole.		Rs.	Rs.
1st and 2nd calving	2—3 Madras measures	70	90
	3—4 ,, ,,	90	120
3rd and 4th calving	2—3 ,, ,,	55	70
	3—4 ,, ,,	70	100
Buffaloes-country.			
1st and 2nd calving	2—3 ,, ,,	60	90
	3—4 ,, ,,	90	120
3rd and 4th calving	2—3 ,, ,,	55	70
	3—4 ,, ,,	70	90
Others.			
Buffaloes-Delhi		120	200
Cows-Cross-bred		150	200

1 Madras measure—4 lbs.

College News & Notes.

Students' Corner—Students' Club—Games Tour. The members of the Students' Club went on a games tour to the West Coast and participated in cricket and hockey matches at Calicut, Tellicherry, Cannanore and Mangalore. The party left Coimbatore on the 15th of September 1939 and played the first series of matches at Calicut on 16—9—39. The College team met the Kerala Glub at a cricket match, in which our team entering first scored a huge total 217 for 2 wickets and declared. The home team batting next compiled a poor total of 57 for 9 wickets. Playing for the college team, C. Ramaswami was unbeaten with 133 which included 12 fours and 6 sixers while H. Shiva Rao retired with a well earned 40. The college team was assisted by K. Dinker Rao our ex-captain who bowled with unerring accuracy and captured 6 wickets for 21 runs.

In a hockey match played on the same day against the Kerala Club our team was defeated by 7 goals to 5.

On the 17th, the party left for Tellicherry and was engaged in a cricket fixture against the local Sports Club. Entering first, our players compiled a total of 126 (C. N. Babu 30. C. Ramaswami 38, Moidu 5 for 28, Haridoss 3 for 27) as against a total of 60 gathered by the home team, Dinker Rao being again the most successful bowler taking 5 wickets for 23. Our team thus won the match.

The Hockey match played against the Town Sports Club on the 18th ended in a draw—the scores being 2 all. As the staff members had to return to their headquarters at this stage, further fixtures were played by teams drawn up from the students alone.

In the cricket matches played at Cannanore against the combined Cannanore XI on 19—9—39 and against M. C. C. at Mangalore on 21—9—39, our College was defeated.

The hockey match played against Young Mens' Club at Cannanore on 20-9-39 ended in a defeat for us by 5 goals to nil, but our team drew their hockey match against the M. H. C. at Mangalore on 21-9-39 the scores being 2 all.

Local Cricket Matches. On 12-10-39, a cricket match was played between 1st and 2nd year students which ended in a draw. Mohiuddin of the 1st year class was unfortunate in missing his century by 5 runs. Batting first the 1st year scored 219 (Mohiuddin 95, S. V. Srinivasan 19, T. Chellappa 26, and K. Sanjiva Shetty 47 not out). The II year compiled a total of 190 for 6, Satynathan making 59, N. Kamath 43 and K. M. Somanna 73. On 14-10-39 the Agricultural college played the Government College, Coimbatore, at home grounds and won the match. Entering first the home team scored 118 (S. V. Srinivasan 43, Sanker Rao 21; and N. Kamath 16, P. B. Srinivasan 8 for 41.) The Government College were all out for 98 (Natesan 33, Ramanath 20, S. V. Srinivasan 6 for 43). A friendly cricket match was played on 15-10-39 between the Estate eleven and the Agricultural College team. The Estate eleven were all out for 145 (Natesan 27, Venugopal 22, Venkatachalam 43, Kothandaraman 6 for 58). The Agricultural College team compiled a total of 235 for 5 and thus won the match (C. Ramaswami 114, H. Shiva Rao 48 retired and Somanna 42 not out).

The Officers Club—Club Day Cricket. This match was played on 6-10-39. The teams were led by Messrs. C. Ramaswami and K. M. Thomas. Batting first Thomas' team put in a total of 203 (Kodandaraman 28, K. M. Thomas 85 retired, N. L. Dutt 29, C. N. Babu 32). Entering next C. Ramaswami's team scored 109 for 9 when the match was abandoned due to rain. (C. Ramaswami 56, K. Sanjiva Shetty 34) The match ended in a draw.

Visitors. A batch of about 30 students from the Hindu College, Guntur led by Sri. Venkateswara Rao, B. Sc. Ag., Lecturer in Agriculture at the Hindu College visited the Agricultural College and Central Farm on 17--10—39.

Students' Tour. The final year B. Sc., Students were on a tour to places of Agricultural interest from 3—10—39 to 18-10-39. The party was led by Messrs. M. Kanti Raj. and T. Nataraj. They visited Tenkasi, Courtallam, Punalur, Nagercoil, Quilon, Trivandrum, Ernakulam, Cochin and Agricultural Research Station, Pattambi.

Officers' Club Day. The Agricultural College annual club day was celebrated on the 21st and 22nd instants with great eclat. The annual dinner was held on the 21st night at 9 P. M. and the rest of the activities connected with the club day where held on the 22nd amidst a number of amusements and a variety of interesting games and items.

Weather Review—SEPTEMBER 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	6·9	−0·6	22·6
	Calingapatam	4·7	−2·7	18·2
	Vizagapatam	2·8	−3·7	14·5
	Anakapalli*	12·0	+4·3	22·1
	Samalkota*			
	Maruteru*	4·4	−2·7	17·5
	Cocanada	5·0	−0·8	22·5
	Masulipatam	5·2	−1·0	17·0
	Guntur*	4·2	−2·1	15·8
Ceded Dists.	Kurnool	3·9	−2·3	13·2
	Nandyal*	0·0	0·0	0·0
	Hagari*	2·8	−2·9	13·3
	Siruguppa*	4·7	−1·8	16·6
	Bellary	2·7	−2·4	10·2
	Anantapur	7·6	+0·3	19·0
	Rentachintala	3·6	...	14·5
	Cuddapah	10·1	+3·8	18·2
	Anantharaju-pet*	2·3	−3·1	13·5
Carnatic	Nellore	1·7	−3·1	9·6
	Madras	5·3	+0·3	14·7
	Palur*	6·7	+3·3	23·1
	Tindivanam*	5·2	+1·3	17·7
	Cuddalore	8·4	+2·3	29·2
Central	Vellore	8·1	+0·8	20·1
	Salem	7·1	+0·5	32·7
	Coimbatore	1·1	−0·4	9·1
	Coimbatore A. C. & R. I.*	0·9	−0·9	9·7
	Trichinopoly	2·1	−2·7	20·3

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	2·2	−1·6	21·5
	Aduthurai*	3·2	+0·4	23·5
	Pamban	0·3	−0·9	8·9
	Madura	6·1	+1·0	24·1
	Koilpatti*	0·0	0·0	0·0
	Palamkottah	0·6	−0·7	6·7
West Coast	Trivandrum	2·7	−1·4	45·4
	Cochin	10·1	+1·1	106·9
	Calicut	4·0	−3·7	97·3
	Pattambi*	3·4	−5·0	80·3
	Taliparamba*	0·0	0·0	0·0
	Kasargode*	6·0	−3·2	110·0
	Nileshwar*	3·8	−5·6	104·7
	Mangalore	5·4	−5·0	104·5
Mysore and Coorg	Chitaldrug	2·9	−1·6	23·6
	Bangalore	6·6	−0·4	24·9
	Mysore	2·2	−2·0	17·1
	Mercara	7·8	−3·0	87·3
Hills	Kodaikanal	5·5	−1·8	33·4
	Coonoor			
	Ootacamund*	3·9	−1·9	25·3
	Nanjanad*	5·5	+0·4	33·3

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette.

Two weak western disturbances and five depressions in the Bay of Bengal were responsible for the wide activity of the monsoon throughout the month. There were general thunder showers in Malabar, Konkan, South Hyderabad and Madras Deccan; local thunder showers in North Hyderabad, Bombay Deccan, North Madras Coast and Mysore and a few falls in South East Madras. The rainfall was in defect in all places except in the Carnatic and parts of the Southern and Central Districts.

Skies were generally, moderately to heavily clouded throughout the Peninsula and the humidity was in excess in South East Madras, Mysore, Madras Deccan and Malabar.

The maximum temperature in shade was above normal in South East Madras while it was below normal in Mysore, Madras Deccan and North Madras Coast. Nellore recorded the highest maximum of 102°F on the 10th.

Chief amounts of rainfall.

Vellore	...	3·7"	on the 8th.
Cocanada	...	3·5"	on the 9th.

Calingapatam	...	3·2″	on the 13th.
Cuddapah	...	4·4″	on the 17th.
Anantapur	...	4·1″	on the 17th.
Cochin	...	3·0″	on the 25th.
Cuddalore	...	3·3″	on the 27th.

Weather Report for Research Institute Observatory.

Report No. 9/39.

Absolute maximum in shade	...	92·0°F
Absolute minimum in shade	...	66·0°F
Mean maximum in shade	...	88·8°F
Departure from normal	...	- 0·7°F
Mean minimum in shade	...	70·8°F
Departure from normal	...	+0·3°F
Total rainfall for the month	...	0·9″
Departure from normal	...	- 0·9″
Heaviest fall in 24 hours	...	0·35″ on 27th.
Number of rainy days	...	3
Mean daily wind velocity	...	3·5 M. P. H.
Departure from normal	...	- 1·8 M. P. H.
Mean humidity at 8 hours	...	76%
Departure from normal	...	+ 2·5%

Summary. But for the local showers on the 10th, 11th and 27th instants, the month was practically dry. The rainfall was 0·9″ of which 0·35″ was received on the 27th. The rainfall was only half the normal amount. Skies were moderately to heavily clouded and the humidity was above normal. The mean maximum temperature was slightly below normal and the mean minimum temperature was very slightly above normal. P. V. R. & F. L. D.

Departmental Notifications.

1. Promotions.

The following promotions of Upper Subordinates in the Agricultural and Science Sections are ordered with effect from 15th August 1939.

Agricultural Section :— Sri. S. V. Doraiswami Ayyar from V grade (old) to IV grade (old).

Science Section :— Sri. P. Satyanarayana and Sri. R. Kochukrishna Pillai from V grade (old) to IV grade (old).

2. Transfers.

Name of officers.	From	To
Sri. P. R. Subramania Ayyar,	Asst. A D., Udayagiri	Tiruttani sub circle.
„ N. Raghava Rao,	Offg. A. D., Nandigama	Science Section as offg. Asst. in Entomology.
„ V. M. Ramunni Kidavu,	F. M., A. R. S, Taliparamba	A. D., Badagara.
Janab Syed Muhammad,	A. D, Tiruppur	A. D., Gudalur to open a new sub circle.
Sri. K. Ramanujacharya,	F. M., A. R. S., Nandyal	A. D., Nandyal.
„ T. Krishna Reddy,	A. D., Nandyal	F. M, A. R. S., Nandyal.
„ K Krishnan	A. D. (on leave)	Gudalur to open a new sub circle.
„ R. Krishnamurthi,	Cotton Asst., A. R. S., Nandyal (on leave)	A. D, Saidapet.

3. Leave.

Name of officers.	Period of leave.
Sri. C. A. S. Ramalingam Pillai, A. D., Ariyalur.	Extension of l. a. p. on m. c for 5 months and 10 days and half average pay for 10 days from 21—5—39.
„ K. Ramanujacharya, F. M., A. R. S., Nandyal.	L. a. p. on m. c. for 2 months from 15—9—39.
„ M. L. Narayana Reddy, Asst., A. D., Palakonda.	Extension of l. a. p. on m. c. for 2 months from 20—9—39.
„ N. V. Narasimhasastri, Asst., A. D. (on leave).	L. a. p for 3 months and 16 days from 16—8—39.
„ K. S. Krishnamurthy Ayyar, A. D, Trichinopoly.	Extension of l a. p for 1 month and 7 days from 1—10—39.
„ C. K. Ramachandran, Asst. in Cotton A. R. S., Hagari.	Earned leave for 45 days from 4-10-39.
„ G. Ganapathy Ayyar, Asst. in Chemistry, Coimbatore.	L. a. p. for 1 month from 2—10—39.
„ Margabandu, V., Asst. in Entomology, Coimbatore.	L. a. p. for 1 month from 9—10—39.
„ K. Hanumantha Rao, Asst. in Paddy, A. R. S., Pattambi.	L. a. p. for 1 month and 21 days from 1—10—39.
Janab P. P. Syed Muhammad, A. D., Tiruppur.	L a. p. for 2 months and 3 days from 26—9—39.
Sri. K. Kuppamuthu, A. D., Cuddalore.	L. a. p. for 2 months from 23—10—39.
Mr. K. Cheriyan Jacob, Asst. in Systematic Botany.	L. a. p. for 1 month and 21 days from 1—11—39

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during September 1939.

A. Books.

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The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

Vol. XXVII.] NOVEMBER 1939 [No. 11.

EDITORIAL

Science and the Indian Farmer. It is now eleven years since the Royal Commission on agriculture in India remarked that in spite of marked progress in several directions, agricultural research in India was still in its infancy. Feeling that the claims of research had till then received only a half-hearted recognition, the Commission recommended the formation of a central organisation to promote, guide and co-ordinate agricultural research throughout India. These recommendations have borne fruit and it is a matter for gratification that the achievements of the Imperial Council of Agricultural Research during the short period of its existence, are of a high order. Besides its own achievements, the existence of this body has given additional impetus to the efforts of the provinces and states in the solution of their agricultural problems.

Now that the Empire is involved in a war any attempt to curtail the expenditure on agricultural research or to cripple the finances of the central body is to be deprecated. Far from curtailing her agricultural activities Britain has shown the lead to the rest of the Empire by improving her home production. Parts of the Empire which lie in the tropical and subtropical regions and whose populations subsist on agriculture have a duty to redouble their efforts in the improvement of their basic industry. The expansion and increase in value of their exportable produce would not only enhance their prosperity but also serve as the surest bulwark for the Empire in a long-drawn struggle where economic superiority would count more than armaments. We trust that this fundamental fact would be recognized by the central and provincial governments in India and that no efforts would be spared to promote research and to harness the results in the production of food stuffs and other essential commodities in the country.

Coffee in South India.

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Historical. Coffee is said to be indigenous to Africa, Abyssinia being the original home, from where it was first introduced into Arabia in the 4th century A. D. Introduction of coffee on a commercial scale to the rest of the world dates only from the 16th century A. D. In India coffee is believed to have been first introduced into Mysore in 1600 by a Moslem pilgrim named Baba Budan, who on his return from Mecca brought a few seeds and sowed them in the hill, which later came to be known as Baba-Budan-Giri in north Mysore. But Baba Budan is reported to have been not interested so much with coffee as an article of beverage as in the production of its fragrant blossoms with which be decorated his mosque. Although Mysore was the first to introduce coffee in India, nothing substantial was done in the direction of extending coffee cultivation till the end of the 18th century. Large scale planting was taken up only in 1835 and hence this industry is only about 100 years old in this country.

The area under coffee in S. India and its relative importance to other plantation crops is furnished in the following table :—

Area in S. India under coffee (corrected to 00, compared with other important hill crops).

District.	Coffee area.	Tea area.	Rubber area.	Cardamom area.	Cinchona.
Coimbatore	2,800	25,300	600	3,000	1,100
Madura	10,500	800	500	1,000	...
Malabar	2,200	1,000	12,400	500	1
Malabar Wynad	5 500	12,400	200	200	...
Nilgris	13,800	24,800	600	13	1,000
Nilgris Wynad	5,000	13,900	600	3	...
Shevaroys	9,500	...	100	18	...
Tinnevelly	400	600	...	100	...
Vizagapatam	600	...	...	...	...
Madras Presy. Total	50,300	78,800	15,000	4834	2,101
Coorg	45,000	400	3,000	3,900	...
British India. Total	95,300	79,200	18,000	8,734	2,101
Cochin	1,600	1,700	11,700	600	...
Mysore	103,500	4,300	600	21,800	...
Travancore	6,200	77,000	97,000	55,000	...
S. Indian States. Total	111,300	83,000	109,300	77,400	...
S. India. Total	206,600	162,200	127,300	86,134	2,101

Varieties. Coffee belongs to the natural order *Rubiaceae*. The genus *Coffea* has about twenty five species in the tropics of the old world, mainly

in Africa. Some of the known forms are the Mocha, Blue-mountain and Nyassa--which are said to be geographical growth forms or varieties of Coffea arabica. Some of the more important economic types are the Sierra Leone coffee (*C. stenophylla*,) Congo coffee (*C robusta*) and *C. excelsa*.

Coffea arabica:— This is a king of the coffee tribe. It is an ever green plant which grows to a height of about 20 feet under natural conditions with oblong-ovate, acuminate, smooth and shiny leaves measuring about 6 inches in length and 2½ inches wide Its flowers which are produced in dense clusters in the axils of leaves, have a five toothed calyx, a tubular five lobed corolla, five stamens and a single bifid style The flowers are white in colour, with a fragrant odour. The fruit is a fleshy berry, having the size and appearance of a small cherry and assumes a red colour when ripe. Each fruit contains two seeds embedded in an yellowish pulp and seeds are enclosed in a thin membranous endocarp (the " parchment "). Between each seed and the *parchment*, is a delicate covering called the "*silver skin*". The seeds are plano-convex in form, the flat surfaces which are laid against each other within the berry having a longitudinal furrow or groove. Occasionally, when only one seed is developed in a fruit, it is not flattened but circular in cross-section, which forms the "*pea-berry*" coffee of commerce.

C. *robusta* :— A more recent introduction than *C. arabica*. It has replaced Arabica, which is highly susceptible to diseases. It is sturdier and more vigorous than arabica—a late bearer but prolific. Leaves are bigger but the fruits are smaller than those of arabica and thrives well at low elevations.

C. Liberica : — The Liberian coffee is a native of the west coast of Africa, grows wild in great abundance along the whole of the Guinea coast. The leaves, flowers and fruits are larger; and the plant is of more robust and hardy constitution than arabica. The seeds yield a highly aromatic and well flavoured coffee (but by no means equal to the arabica).

Climate and Soil. In Mysore 4500 feet is said to be the limit at which coffee can bear, whereas good healthy plantations at 5000′ to 6000′ are seen in the Nilgiris. Aspect and exposure are important factors. High altitudes with suitable soil produce a very good quality of bean, for it must be remembered that in coffee, it is not only the quantity but also the quality that counts. Mysore which has the largest area under coffee in India, has most of its plantations at altitudes of 3000 to 4000′ with an annual rainfall of 50 to 130 inches.

Coffee is essentially a surface feeder and therefore the richer the top soil the better. In fact the coffee growing land is in the hill tract which has luxuriant forest growth and this is a positive indication of the inherent fertility of the soil. The fertility of any piece of coffee land over long periods should depend on the optimum depth of surface soil in which a high humus and nutrient status is maintained by resisting soil erosion and preserving

right physical properties. High water holding capacity is a most important property of these soils for they must be able to retain as much of rain water as possible which they can give up again to meet the requirements of the crop during prolonged periods of drought. A forest loam of 7 to 8 feet depth with the above mentioned properties is the most ideal for coffee growing although coffee can grow in a variety of soils from clayey to sandy loams.

Transport and Labour. The estate must be approachable by roads which are necessary for the transport of produce to the nearest railway station or to the curing houses and this is not a matter of great difficulty in these days of motor traffic. Supply of labour should be well organised and this is usually done by 'agents' or 'labour suppliers' with whom the planter should deal tactfully. The coolies of the estate are given an advance of Rs. 5 to Rs. 10 in the beginning of the year through the agent who supplies the coolies and this is recovered from the wages earned by the coolies during the rest of the year. The agent earns a commission of about 10% on the out-turn of work. The agent earns the commission regularly but he is responsible for the amount advanced to the coolies. The supply of labour to an estate may be from the villages round about, and more often they come from neighbouring districts but it is not unusual to see some from distant districts.

Raising of the Nursery. Seed is purchased from reliable planters and sown in the germination beds Ripe red "cherry" from selected plants are picked and the beans are separated from the pulp by treading them under feet. The beans are then put in water, well stirred, floating beans are rejected, and the rest are put in mats or sieves, mixed with wood ashes and dried in the shade for a week. The seeds are now ready for sowing in the beds.

Germinating beds. These are raised beds of 3 to 4 feet width and any convenient length. A fine tilth is necessary. Seeds are dibbled in these beds 1 inch apart and the seed bed is covered with straw or fern placed over wooden or bamboo poles kept across the beds. The seed bed is watered twice daily and germination takes place in four to six weeks. The seedlings plants remain in the bed for about six weeks when they are transplanted either in nurseries or baskets.

Nursery. The nursery is raised in the same manner as the germinating beds. The raised beds are of fine tilth and are manured with well rotten cattle manure or compost. A temporary *pandal* is erected over the nursery to ward off the severe sun. As the seeds germinate in the seed bed or after the cotyledon leaves open, the seedlings are carefully lifted without damage to their roots and planted in the nursery six inches apart. Planting is done by making a hole to the required depth of the tap root with a wooden peg, care being taken to see that the tap root is not bent Earth at the base of the seedlings is firmly pressed around the seedlings to give them a foothold. Watering is thereafter done twice a day till the seedlings are established. The plants are ready for planting in 9 to 12 months.

Basket Plants. Another desirable method of raising seedlings is in baskets, in which the seedlings grow vigorously and this system is to be advocated although it is slightly more expensive. Bamboo baskets of 3 to 4 inches diameter and 9 inches depth may be purchased at about Rs. 5 per 1000. These are filled with virgin jungle soil, well mixed with well decomposed farm yard manure and the germinated seedlings which are about four to six weeks old in the nursery are planted in them. The baskets are arranged in rows to give the same spacing as the plants in the nursery and treated in the same way. Plants raised in this manner are ready for planting in six months. The baskets are directly transferred to the planting pits.

Laying out of the Plantation. The block of land where coffee is proposed to be planted is to be cleared first. In modern plantations, coffee is grown under regulated shade in which case the entire area is to be completely cleared and fresh shade trees planted, but if there are suitable trees in the jungle they are left as such. Rain water dripping from big trees has an adverse effect on the growth of young coffee plants. The required number of shade trees at 25 to 50 feet apart are planted and roads and drains are laid out to suit the contour of the land. The land is thus got ready for planting.

Lining. This is the first operation before planting. This consists of marking out pegs at the places where pits have to be dug. The land being usually in a slope, it is advisable to form the lines across the slope which will greatly minimise the chances of soil erosion. The usual spacing is 6′ by 6′ for arabica plants and 8′ to 9′ for robusta. Pegs are driven after proper alignment and pits $1\frac{1}{2}'$ cube are dug in January—February to enable the planting being done in June after proper weathering of the sub soil in the pits. 1200 pits go to the acre at 6 feet spacing.

Importance of shade Shading of coffee trees is an important item. Shading has manifold advantages in that, it protects the crops from the severity of summer heat, helps the conservation of soil moisture by reduced evaporation, maintains an equable temperature and humid conditions which are necessary for the production of even and regular crops and replaces the valuable humus of the soil and produces a mulch of fallen leaves. Besides these, shade mitigates the damage by borer and leaf diseases, both of which are favoured by high light intensities. It seems likely that if it were not for the pests, shade in South India might be kept lighter than it normally is Apart fron *Grevillea robusta* and *Erythrina lithosperma* whose function is mainly as nurse trees, several species of *Albizzia* and *Ficus, Pterocarpus marsupium, Artocarpus-integrifolia Terminalia belerica, Dalbergia latifolia, Eugenia jambolana* etc. are planted, the choice of the variety depending on the local conditions. It is to be noted that coffee is naturally an undergrowth species and recent work in Africa has shown that coffee does not properly photosynthesize at full capacity in full sunlight. Stakes of Dadap (*Erythrina lithosperma*) are planted at 12 ft. apart in a newly cleared

area. By gradual ringing out, the permanent shade trees of a plantation are so maintained as to have trees at about 40′ apart.

Planting. The pits are filled with the top soil. The seedlings raised in the nurseries are planted in the month of June with the advent of south west monsoon showers, whereas the basket plants which are more vigorous and healthier are planted in September (close of the S. W. Monsoon) as a smaller amount of rainfall is sufficient for the establishment of these plants. During planting, care is taken to see that the plants are inserted in the centre of the pits so that all the plants in a row may be in a line. If necessary the tap root may be slightly pruned and then planted. The basket plants are introduced into the pits with the basket. The seedlings after planting are given some shade by sticking in leafy branches close to them.

After-cultivation. In normal practice, young coffee is intercultivated during the first two or three years, usually about October. As the coffee closes in, this cultivation is restricted to a smaller area to minimise root injury. On the whole, where mulch and shade are good, regular intercultivation with implements is to be avoided. Hand weeding is done two or three times a year, to have the estate free of weeds before the end of the north east monsoon rains. In some plantations of the *malnad* area two *mummatty* hoeings are given. The first operation immediately precedes the S. W. Monsoon, when the soil round the plants is dug out to create a loose mulch. This is known as '*Kochu-agathe*' in kanarese. The second operation done in September - October involves the burial of weeds in addition to digging round plants and hence called '*Muchu-agathe*'.

Manures and Manuring. Although coffee soils are usually rich in organic matter and humus, it is not possible to raise successful crops of coffee year after year without manuring Whatever may be the inherent fertility of these soils, it is not inexhaustible and manuring becomes a prime necessity. Farm yard manure, pulp compost and compost of leaf and other vegetable debris are the chief sources of manure in a coffee estate. A basket of the compost (30 to 40 lbs) or cattle manure is applied per plant once in four years with good results. The manure is either applied round the plants and then forked in or applied in semicircular trenches dug round the plants and covered. These trenches are dug at the sloping side of the land. Coffee responds to manuring with artificial fertilisers containing suitable proportions of Nitrogen, Potash and Phosphorus and these are applied round the plants and forked in. A mixture of artificial fertilisers containing N, P & K in the proportion of 1 : 2 : 3 is said to greatly augment the yields. The results of manurial trials on coffee at the Balehonnur Experimental station indicate that a complete fertiliser consisting of N, P, and K has given the best result—the amount of application being; N-20 lbs, P_2O_5—30 lbs and K_2O—60 lbs. per acre. Nitrogen is supplied in the form of ground nut cake, ammonium sulphate, nitrate of soda, or am. phosphate, P_2O_5 in the form of any phosphatic manure like, superphosphate, bonemeal and potash in the form of potassium sulphate. The time of application is usually in

September. Studies for determining the optimum conditions of soil reaction for the growth of coffee have been pursued at the Balehonnur Experimental station by growing the plants in Hydrogen ion cisterns in which the soils have been rendered artificially alkaline or acidic with pH values varying from 4·5 to 8. "An almost neutral condition of soil is indicated to be very favourable for the healthy growth of coffee".

Topping. In about two to three years after planting, coffee attains a height of 3 to 4 feet at which stage, the plants have to be topped with a sharp knife. By this method the vertical growth of the plant is maintained at a definite height. The first topping is done at a height of $2\frac{1}{2}$ feet from the ground level and this operation is done by trained coolies. Gradually the plants grow and consequent to this operation, new 'suckers' are put forth and the height of the plants is increased to $3\frac{1}{2}$ to 4 feet by annual toppings. This is the maximum limit of height to which coffee can be allowed to grow and this height is maintained throughout the life of a plant as picking of berries is convenient at this height.

Pruning. Pruning is done regularly and systematically every year for without it, the plants will never yield well. This operation is attended to after the harvest of coffee and ordinarily no pruning may be necessry till the plants are five year old. In Brazil—the premier coffee producing centre of the world, no pruning is done and plants are allowed to grow to 12 to 15 feet high. This is possible in Brazil where the method of cultivation is entirely different, where four plants instead of one are planted in a hole and the soil is of such exceptional fertility. Pruning is an indispensable operation which consists in cutting back of old wood which has borne one or two crops, to the point of origin of newer wood, removal of 'gormandisers' (branches growing vigorously upwards which sap the vitality of the tree) and superfluous wood. Though pruning is normally done after a crop 'suckering' is done during weeding rounds, when the suckers are soft; enough to be pulled out.

Scrubbing of Moss. In the trunks and branches of coffee plants mosses grow luxuriantly, if left undisturbed. The development of moss on the stem of plants weakens them considerably and the moss offers a safe shelter to the stem borer *Xylotrechus quadripes* to lay its eggs. The moss is to be scrubbed off the plants with pieces of gunnies. This is usually done during monsoon or in November with the dual purpose of removing moss and smoothening out bark crevices and crushing borer eggs which may occur in them.

Flowering and Fruiting. An inch of rainfall in the month of March. after a dry spell of about two months is greatly needed for the proper opening of the 'spikes' and setting of the blossom and this rain greatly influences the yield. Although rain fall at this time is an important factor the condition of the plants in the preceding N. E. Monsoon season, largely determines the yield, all manuring and cultural operations notwithstanding

Harvesting. Harvesting begins in the month of November—December and it takes nearly seven months for the berries to ripen. Coffee begins to bear in the 3rd or the 4th year but full bearing is attained from the 6th to 8th year. Harvesting in arabica plants—which are early bearers begins in November—December, whereas in robusta it is in January—February. The crop does not ripen uniformly; hence coolies are sent to pick the berries as they ripen. The pickers run from plant to plant picking only the ripe berries and this is called 'fly picking'. Thereafter, the berries ripen in larger numbers and the collection of ripe berries is repeated four or five times. In the end, both the ripe and unripe berries are picked together and this method of picking is known as 'stripping.' The stripped produce is kept and dried separately. A cooly can pick as much as 1 to 1½ bushels of berries in a day when the crop is in full swing—a bushel of ripe berries weighing about 55 lb. Picking of berries is done by the coolies in baskets or gunnies which are tied round their waists.

The last operation is 'gleaning' which consists in picking fallen berries and beans and also those that have been eaten by monkeys and squirrels and deposited in the field. Boys are sent for this work and are paid about 6 pies for a seer (2 lb.) of beans collected.

Yield. In India the average yield is about 500 lbs. of cured coffee per acre. The ordinary yield of a coffee plantation in the 4th year of planting is about 50 lb. per acre rising up to 150 to 200 lb. in the 5th year, 300 lbs. in the 6th and 500 lbs. in the 7th and succeeding years. This yield is maintained, under favourable conditions till the plants are about 50 years old. The yield of a plantation is estimated by the planter as so many bushels of cherry per acre and this gives an idea of the quantity of the finished product, as the finished produce is roughly one fifth to one sixth of the weight of the 'cherry'.

Preparation of Coffee for the Market. Much experience is needed in the preparation and grading of the produce after harvest as the quality of the resultant product mostly depends on how best the commodity is dealt with. Other conditions being equal, the price chiefly rests with this factor.

The pulp house and the pulping machine. The pulping house and the machinery are erected at the lower reaches of the plantation and the drying grounds are prepared nearby. The size of the building and the machinery depends on the maximum expected daily harvest during the crop period. An unfailing supply of fresh water is indispensable for pulping operations. Water supply is usually obtained by erecting dams across natural streams or from wells dug at a higher level than the pulping house, pumped and led through pipes to the pulping machine. Pulping machines are of various makes and designs, but all are the same in principle. The essential parts of the pulping machine consist of two pairs of metallic discs one pair fixed below the other. The discs are covered with copper sheets having rough excrescences on the surface. The pulping machine is connected on to a motive power with a horizontal connecting rod with suitable

gears and crank shaft arrangement. The motive power may be an oil engine, a water turbine or bullock power. The bullocks work the pulper in the same fashion as a sugarcane mill or the persian water wheel, where the connecting rod is fixed on to a bevelled gear.

The discs of the pulper are adjusted so as not to crush the beans but only squeeze out the bean out of the cherry. There is also another kind of pulper called the barrel or breast pulper in which a cylinder is rotated against fixed 'chops' called breasts. Small estates use hand pulpers.

Pulping. The days' picking of cherry is collected on a loft above the pulper usually on the top floor of the pulp house. It is to be emphasised that only ripe red cherry are to be selected for pulping—discarding all the half ripe and immature ones, which go with the stripped produce for drying separately. The pulper is worked and the cherry is fed to the pulper through a stream of water over a catch pit to prevent the flow of any stones into the machine which will damage the discs and throw the machinery out of work. Great precaution is to be taken in this direction, to see that the machinery is in perfect condition as otherwise considerable loss is likely to be caused by the cessation of work resulting in the deterioration of the cherry which affects the quality of the produce. The pulped beans flow with the running water to the masonry vat fil'ed with water, while the pulp is ejected through separate channels. After pulping is over, water from the vat where the beans have collected, is completely, drained and the beans are heaped and stored for fermentation in the vat for about 36 hours. The fermentation is necessary to get rid of the saccharine slimy coat on the parchment and this must be carefully attended to, as excess or insufficient, fermentation affects the quality of coffee. After optimum fermentation the beans are vigorously trampled under feet and washed with three to four changes of water till all the slimy, matter is completely got rid of.

During the cleaning of the beans in the vats after fermenation, beans that float in the water are separated, dried and marketed as 'lights' whereas such of the beans from which the seed coat and pulp has not been fully removed, are again dried and marketed as 'tails'.

The cleaned beans are then transferred to drying tables covered with coir mattings or which consist of wire trays where they are dried for about a fortnight. Drying is stopped when a struck bushel weighs 33 lb. and at this stage, they are bagged and are ready for transport to the curing factories. In the curing factories, parchment is hulled polished, picked, and graded. Single beans from this lot are picked and bagged separately and this goes under the trade name of "pea-berry" whereas the double beans are sold as "parchment". In S. India the pea-berry fetches a premium of Rs. 80 to 100 per ton over 'parchment.'

The strippings are dried in the sun as they are picked. Each day's collection is separately dried and the berries get a dark colour as they dry. In small plantations where there are no facilities for pulping, even the ripe berries are treated in the same way as the strippings and are dried. Drying is complete in a week to 10 days, when they are put in a huller or pounded in a mortar for the removal of the dry skin which becomes hard like shells of groundnuts. After hulling the produce is cleaned and bagged and sent to the curing factories as 'Cherry' or 'Native coffee'. In the curing factories these are graded in sieves, further picked and graded. This is the quality that is mostly in demand for local consumption by middle class people, as it is comparitively cheaper.

Price of coffee. The price of coffee is the vital factor that governs the conduct of various agricultural operations in the cultivation of this crop. The price per ton of coffee was Rs. 1500 to Rs. 1800 during the boom period as compared with the present rate of about Rs. 650. The future of this industry appears to be dark unless there is rise in price. Planting will only thrive if the price reaches a level of at least Rs. 800 to 1000 per ton.

Longevity of coffee. The longevity of a coffee plant depends mostly on the efficiency of management, the soil conditions and freedom from diseases. The plant begins to bear in the 4th year, attains full bearing capacity in the 7th or 8th year and continues to do so, under normal conditions for 70 to 80 years. There are plantations that are about 60 to 70 years old and are still yielding well and under ideal conditions they may continue to yield well up to 80 to 90 years.

Pests and diseases of coffee. Squirrels, monkeys, porcupines and other wild animals cause damage to a coffee plantation. Monkeys in herds attack a crop when the berries are ripe and cause considerable damage—but this after all is a minor matter compared with insect pests and fungus diseases. Some of the insect pests, in the order of importance, are the coffee stem borer *(Xylotrechus quadripes)* green bug *(Lecanium viride)* black or brown bug *(Saissetia haemispherica)* and twig borers *(Xyleborus pp).* The stem borer lays its egg singly in the crevices of coffee stem. The hatching of eggs is favoured by hot sunshine, the larva bores a hole into the stem and spends the rest of the period in its life history inside the plant, taking nearly 9 months for pupation. The pest is most active in the adult stages in October —November and scrubbing operation designed to crush the eggs must be done at this stage. Tar wash applied to the affected stems kills the eggs.

Among the fungoid diseases, 'leaf disease' caused by (*Hemeleia vastatrix*) black rot' caused by (*Corticium koleroga*) and die back' associated with a species of *Gloeosporium* are the most common. While breeding of disease resistant varieties is the most effective weapon to combat these diseases, spraying with Bordeaux mixture is the first line of defence. A half per cent mixture is found to be as effective as one per cent and this is very widely practised.

Cost of raising a garden up to the bearing stage In estimating the cost of bringing a coffee plantation up to the stage of bearing two things are to be borne in mind, viz, the capital outlay and the recurring charges. The former depends on the extent of cultivation and the proportionate cost of fixed charge will have to be added to the recurring charges to give a correct estimate of raising an acre of coffee till the bearing stage. 200 acres of coffee plantation will be a fair unit for working out the fixed charges and on this basis the following figures are computed. The figures, naturally, are variable from tract to tract.

TABLE I. Fixed and Annual Recurring Charges for a Plantation of 200 acres of Coffee.

Capital Outlay :

Cost of 200 acres of coffee land @ Rs. 50 per acre	...	Rs.	10,000	0	0
Bungalow for the owner or the Superintendent	...	Rs.	5,000	0	0
House for the estate conductor or clerk	...	Rs.	1,000	0	0
Store and drying floor	...	Rs.	1,000	0	0
Pulping house, vats, barbecues etc.	...	Rs.	2,000	0	0
Machinery for Pulping and accessories	...	Rs.	1,500	0	0
Provision of water supply (well etc.)	...	Rs.	500	0	0
Cooly lines, 50 at Rs 100 per house	...	Rs.	5,000	0	0
Tools and implements	...	Rs.	500	0	0
Sprayers	...	Rs.	2000	0	0
Sundries	...	Rs.	500	0	0
Total	...	Rs.	29,000	0	0

Annual Recurring Expenditure :—

Superintendent @ Rs. 200 per month	...	Rs.	2,400	0	0
Conductor's or clerk's pay at Rs. 40 per month	...	Rs.	480	0	0
Watchmen—two at Rs. 8 per month	...	Rs	192	0	0
Storekeeper at Rs. 20 per month	...	Rs.	240	0	0
Medicines—cost of	...	Rs.	50	0	0
Stationery, postage and books	...	Rs.	100	0	0
Upkeep of buildings (2% on cost)	...	Rs.	250	0	0
Roads and drains—Repairs and upkeep	...	Rs.	200	0	0
Maistries 3—@ Rs. 12 per month	...	Rs.	432	0	0
Spraying materials and labour for spraying @ Rs. 8 per acre	...	Rs.	1,600	0	0
Repairs to tools and machinery	...	Rs.	200	0	0
Shade regulation; renovation and sundries	...	Rs.	200	0	0
Transport etc.	...	Rs.	100	0	0
Allowances, commission etc.	...	Rs.	300	0	0
Total	...	Rs.	6,744	0	0

TABLE II-A. Cost of cultivating one acre of Coffee up to the period of full bearing—1st year.

Cultivation details.		Expenditure.			
Preparatory Cultivation.					
Clearing jungle growth, felling forests and burning etc.— 120 coolies at 4 annas each	...	Rs.	30	0	0
Lining 6' x 6' and Pegging—8 @ 4 annas	...	Rs.	2	0	0
Digging pits—1200—1½ ft. cubs--40 @ 4 as	...	Rs.	10	0	0

Filling pits—12 @ 4 as.	...	Rs. 3 0 0
Digging 300 pits for shade trees and filling 15 @ 4 as.	...	Rs. 3 12 0
Seeds and Plants.		
Planting 300 shade trees—2 @ 4 as.	...	Rs. 0 8 0
Planting 1200 coffee seedlings —8 @ 4 as.	...	Rs. 2 0 0
Cost of 300 seedlings for shade trees 12′ - 12′ 2 Rs. per 100	...	Rs. 6 0 0
Cost of 1200 coffee seedlings @ 2 Rs. per 100	...	Rs. 24 0 0
Providing temporary shade—6 @ 4 as.	...	Rs. 1 8 0
After cultivation.		
Hoeing round plants once—50 @ 4 as.	...	Rs. 12 8 0
Weeding twice—32 @ 3 as.	...	Rs. 6 0 0
Agent's commission on labour charges alone (10% on Rs. 70)	...	Rs. 7 0 0
Assessment on land per acre	...	Rs. 1 8 0
Total expenditure for the first year	...	Rs. 109 12 0

TABLE II-B. **Details of cost of cultivation from the 2nd to 7th year.**

Details of operation.	2nd year.	3rd year.	4th year.	5th year.	6th year.	7th year.
Hoeing round plants once 50 @ 4 as.	12 8 0	12 8 0	12 8 0	12 8 0	12 8 0	12 8 0
Weeding twice 32 @ 3 as.	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0
Manuring with 1200 baskets of F. Y. M. @ 50 baskets per Rupee.	*6 0 0	*6 0 0	*6 0 0	*6 0 0	*6 0 0	*6 0 0
Applying manure 16 @ 4 as.	*1 0 0	*1 0 0	*1 0 0	*1 0 0	*1 0 0	*1 0 0
Topping 1200 plants 8 @ 4 as.	...	2 0 0	...	...	...	...
Suckering and pruning	...	...	5 0 0	8 0 0	8 0 0	8 0 0
Picking coffee and Preparing @ 8 as. a bushel	...	...	2 8 0	10 0 0	15 0 0	25 0 0
Agents commission @ 10% on Labour cost.	2 0 0	2 0 0	2 12 0	3 12 0	4 4 0	5 4 0
Assesement on land	1 8 0	1 8 0	1 8 0	1 8 0	1 8 0	1 8 0
Cost per acre	29 0 0	31 0 0	37 4 0	48 12 0	54 4 0	65 4 0

* As farm yard manure is usually applied once in four years the cost of 1200 baskets of manure (24—0—0) and the cost of applying (4—0—0) is proportionately charged for each year.

Total cost of one acre from the first to the 7th year is		Rs. 375 4 0
Yield of coffee in fourth year—	50 lb @ Rs. 7 per 25 lb	Rs 14 0 0
Do. fifth do.	200 lb @ Rs. 7 per 25 lb	Rs. 56 0 0
Do. sixth do.	300 lb @ Rs. 7 per 25 lb	Rs. 84 0 0
Do. seventh do.	500 lb @ Rs. 7 per 25 lb	Rs. 140 0 0
Cost of produce up to the 7th year		Rs. 294 0 0

From the details given above, it can now be seen that for the management and cultivation of a 200 acres coffee estate, Rs. 29000 are required for capital expenditure, Rs. 6744 towards annual recurring expenditure, besides the actual cost of cultivation. The cost of raising an acre up to the stage (7th year) of full bearing may be classified as follows.

1. Interest on capital Rs. 29000 @ 4%.
2. Annual recurring expenditure.
3. Cost of cultivation.

Particulars.	for 200 acres per year	for 1 acre per year	for 1 acre for 7 years
Interest @ 4% on Rs. 29,000	1160 0 0	5 13 0	40 11 0
Annual recurring Expenditure	6744 0 0	33 11 0	235 13 0
Cost of cultivation	...	...	375 4 0
Total			651 12 0
Less the value of produce up to 7 years			Rs. 294 0 0
Net cost of raising an acre up to 7th year			Rs. 357 12 0
			or Rs 358 0 0

Net cost of bringing 200 acres to bearing stage Rs. 71600.

From the Table II-b, it is evident that coffee begins to pay from the 5th year with a distinct margin of profit.

Economics. From the above statement it is seen that the owner of a 200 acre plantation has invested Rs 29,000 on capital outlay and Rs. 71,600 on cultivation and recurring expenditure. He would have thus invested Rs. 104600 at the end of 7th year on a 200 acre estate. From the 7th year onwards he gets a net profit of Rs. 47 per acre or Rs. 9400 on the holding which works out to a 9% return on invested capital.

Summary and Conclusions. Coffee is an important South Indian industry. Although the yield in Indian plantations is comparatively poor the quality of the produce is one of the best in the world.

The yield of coffee is largely dependent on the blossom showers in March and the condition of the plants in the preceding North-East Monsoon season.

Coffea arabica—the finest of the coffee species is being fast replaced in the lower elevations by robusta—a prolific bearer of low grade. The replacement of arabica by robusta is likely to slacken in the future as the export market for this type is very low and the internal market is reaching saturation. Arabica is highly susceptible to leaf disease.

The cultural and manurial treatments given to coffee plantations at the present time are highly inadequate owing to the tendency on the part of the planters to minimise cost of cultivation as a result of fallen prices.

The future of this industry is dark unless there is a rise in the price level. Protection to coffee as is given for tea and rubber may save the industry from disaster and this is possible only by international negotiations with big producing countries like South and Central America.

Acknowledgements. The writer is greatly indebted to Mr. W. W. Mayne, B. Sc., Coffee Scientific officer of the United Planters' Association of S. India, for reading through his manuscripts and making very valuable suggestions. He is also grateful to Messrs. S. T. Shetty and S. D. Shetty of Umbdi Estate (Koppa-Kadur) for affording him all facilities to gain first hand knowledge of coffee plantation work

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Some Animals of Agricultural Importance in South India.

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Introduction. Though the great majority of the numerous pests affecting cultivated plants and stored agricultural products all over the world belong to the group of insects, we occasionally come across creatures other than insects which often prove equally injurious. In South India the non-insect forms so far noted include representatives of such animal groups as Worms, Molluscs Crustaceans, Arachinids, and Myriapods among lower animals and such higher forms as monkeys, bats, rodents of sorts, wild animals like elephants, jackals, wild pigs, deer, bison, many birds, and at least one fish.

Non Insect Pests. *Lower Animals.* Among the non-insect lower animals which affect the farmer's crops the more important are eel worms, snails and slugs, crabs, mites, ticks, and millipedes.

Eel worms are very minute worms belonging to the group of round worms *(Nemathelminthes)* and derive their name from their resemblance to fishes called eels. There are numerous forms among these which attack cultivated crops of different kinds often causing serious damage. They attack the rootlets of plants and cause the characteristic knots or nodules in which the worms breed, resulting in the gradual fading and death of such plants Infested plants when pulled out of the soil, will reveal numerous nodules, and when these are teased and examined under a microscope different stages of these worms can be seen. The most notorious and widely distributed of these eel worms is the root-gall eel-worm

(Heterodera marioni, G). This has been noted on numerous crops all over the world, and in S. India, the most important plants subject to such attacks, are pepper, betelvine, brinjal, tomato, tobacco, tea, pulses, turmeric, cucurbits, groundnuts and cruciferous plants like cabbage, cauliflower and mustard. It is often a difficult problem to control the eel-worm pest when the field is badly infested, since the pest remains in the soil even after the field is harvested and is capable of reinfesting the next crop. Rotation of crops, proper disposal of crop-remains after harvest, keeping the land fallow for a few seasons and the use of soil disinfectants are some of the well-known methods of control.

Snails and slugs belong to the group of shelled animals known as Mollusca. Though the great majority of these are aquatic forms, snails and slugs are not strictly aquatic, as they also live on land and are often found feeding on vegetation. Snails have an external spiral shell covering their soft body while slugs do not generally possess such a conspicuous shell. Though these are not regular pests, garden plants of different kinds are occasionally attacked by them. Aloes are sometimes found attacked by snails and holes are found bored on the succulent leaves. In S. India, these generally include species of Kesta, Rhacis and Ariophanta. On one or two occasions, paddy seedlings have been reported as damaged by small snails in parts of the Kistna delta near Tenali. These creatures are seen during wet weather and in damp areas and are generally active during the night. During dry weather, snails may be found sealed fast to various plants and tree stems; they revive and become active with the return of humid and wet conditions. Slugs are soft, flattish, slimy, slow-moving creatures. They are now and then found in numbers in betelvine gardens occasionally nibbling *agathi* (*Sesbania grandiflora*) and betel leaves. These creatures as they move about leave behind them a slimy shining trail on the ground. Generally the damage to plants by these forms is negligible in S. India. When found in numbers, they may be checked by hand picking and by the use of irritants or poison baits. The use of one part of calcium arsenate with sixteen parts of wheat bran mixed dry and moistened with enough water to make the mixture sticky and scattered in the haunts of snails has been found effective against the garden snail in California. Spreading of lime, soot, wood ashes, etc. on the ground also acts as a deterrant against slugs.

Crabs are familiar creatures which come under the group Crustacea in which are also included the prawns, lobsters, water fleas etc. Crabs have a flattish oval body with ten conspicuous legs and the abdomen tucked under the thorax. The great majority of crabs are marine forms. The fresh water crabs are the ones which have been noted to cause considerable damage during certain years to young paddy plants in different parts of India and Burma. In S. India they are frequently reported to cause damage in the Cauvery Delta. Though in their food habits crabs are generally carnivorous, this plant-feeding habit has been noted in some fresh water species. During

the time when the paddy crop is very young these creatures cut the tender plants at ground level and carry the pieces to their holes to be used as food. This is generally done during dusk or at night. The species of fresh water crab commonly noted to cause such damage in S. India is *Paratelpnusa hydrodromus*, H. The pest can be controlled by hand picking, baiting with poisoned food (by dropping the bait into the crab holes) or trapping them in narrow-mouthed earthen pots planted along the edge of the water channels. Though in the Laccadive islands and in the Malay archipelago, a crab known as the coconut crab *(Birgus)* is found as a serious pest of coconut, we have not as yet met with this creature on coconut along our coastal areas.

Mites belong to the class Arachnida which includes the spiders, scorpions, ticks, etc. Mites are minute creatures with oval or elongate oval body having eight legs. Different species are found on plants sucking up the plant sap and causing damage. The effect on the attacked plant is generally a discoloration and paleness due to sap drainage. Often these, mites cause galls on some plants. Well known pests are the Cholam mite *(Paratetranychus indicus*, H.) the citrus mite *(Tetranychus hindustanicus*, H) the cotton mite (*Anychus latus* C and F.) the tea mite (*Tetranychus bioculatus* W. M.) and the castor and ganja mite *(Tetranychus telarius* L.*)*. The last one has a world wide distribution and has been noted on numerous other plants also. Ticks and some species of mites attack cattle and other domestic animals and at times on man as skin parasites. Application of flowers of sulphur or spraying with lime sulphur solution will be found effective against mites on plants.

Millipedes are elongate cylindrical creatures occasionally noticed, damaging roots of plants in vegetable gardens and damaging the pods of groundnuts in some areas emptying the shell of its contents. These can be controlled in the same way as cutworms, white ants and wire worms by such measures as the use of poisoned baits, poisoning the irrigation water etc.

Higher Animals. Though fishes are not as a rule known as pests of crops one locally called *Anaikuthu pambu* (*Ophichthys boro.* H.) has been noted as such in parts of S. India. This causes damage to paddy field bunds along the Coromandel coast. It is a long flat eel fish having the general appearance of a snake and lives in the tidal streams and estuaries along the coast. No direct harm is caused to the growing plants but numbers of these eels burrowing into and making passages across the field bunds cause salt water to enter the paddy fields and damage the growing plants. Sometimes damage is also caused to salt pans on the coast. The radical measure of control against this pest is to strengthen the bunds and prevent admission of the fish from the salt water area into cultivated fields. They can also be trapped by mechanical methods and destroyed. Among the well known higher forms of animals found doing damage to crops may be included rats, squirrels, rabbits monkeys, flying foxes (Pteropus) and some graminivorous and fruit-eating birds. Among rats there are some

species which live in fields and attack crops like paddy, sugarcane, coconuts, etc., while there are others which are household and granary pests. The most destructive and well-known of our field rats damaging crops are the mole rat, (*Gunomys kok*) the Indian Gerbille, (*Tatera cuvieri Gr.*), the coconut attacking species *Rattus rattus*, Bl., and the common house rat *Rattus rufescens*, G. In parts of the Malabar coast there is an aquatic rat known locally as *Neeteli* often causing severe damage to the paddy crop which is just putting out earheads. Squirrels are also troublesome in fruit and vegetable gardens and farm houses where grains and seeds are exposed for drying. The flying squirrel known as *Pathada* in S. Malabar also destroys tender nuts on coconut trees. The depredations caused by monkeys in different parts of the country are well known. The flying fox (Pteropus) a species of large bat is often found in colonies on some trees. These cause damage to fruit crops in the surrounding areas.

The usual control measures against the above mentioned pest consist of poisoned bait traps, or fumigation of their habitations. For the coconut tree rat, galvanised iron bands may be fitted to prevent them climbing the tree. In addition to rats and squirrels, field crops in some areas are often subject to the attacks of jackals, wild boars, mangooses, toddy cats, porcupines, bison, deer and even elephants; especially is this the case in forest tracts and in areas along the foot hills of the western ghats. Jackals are partial to sugarcane and wild pigs to root crops and paddy. The control of these pests in the case of valuable crops like sugarcane can be effected by good fences and in submontane areas where there is trouble with wild animals like elephants, they have to be kept in check by the creation of natural barriers like mhotes or with the use of the hunter's gun. Among injurious birds, the omnivorous crow, the cosmopolitan house sparrow, pigeons, parrots of different kinds and some other grain and fruit eating birds which appear during certain seasons of the year are the most important of our bird pests. Different methods, including trapping, poisoning, scaring and shooting are employed to keep them in check.

Insectivorus Animals. Coming to the pleasanter side of the picture we find that, as in the case of insects feeding on other insects and often helping the farmer in controlling pests as parasites or predators, there are among non-insect animals also several forms which are insectivorous and which in many cases help us considerably in checking insect pests. These include toads, lizards, birds, bats, spiders, etc. Toads, lizards, chameleons, snakes and some fish play very important roles in nature in keeping insect multiplication under control. Flies, mosquitoes and numerous other insects are eaten by these amphibians and reptiles. Kirkaland in his account of his observations on the American toad, has found that its food is made up of 88% of insects of which 16% are the injurious cut worm caterpillars. The usefulness of some snakes as destroyers of rats and mice is also well known but unfortunately many a harmless snake meets with death at our hands for the fault of a few of their tribe. The more important of these insectivorous,

animals, however, belong to the group of birds though, as stated before, we have even among these, some which are notorious pests and some which take to both vegetable and insect food. Some of these insect-feeding forms play the role of very efficient natural checks of insect pests of different kinds though some of these insectivorous birds like the bee-eater (*Merops viridis*) cause damage by attacking the honey bee. The most important of these insect-feeding birds, helpful to the farmer, in the plains of South India are the mynah, the king crow, the roller, the hoopoe, the wood-pecker, the jailor bird, the bulbul, the tree pie, the fly catcher, the owl, the paddy bird domestic fowls, ducks and turkeys. Some of these birds voraciously feed on such injurious caterpillars and grass-hoppers like the swarming caterpillar of paddy and the allied cutworms, the castor semilooper white grubs, mango hoppers etc. The common crow being omnivorous is at once an injurious and a benificial bird ; it is graminivorous and consequently a domestic pest but it often does beneficial work by feeding on insects of different kinds. We commonly find the crow following the plough and feeding on underground grubs, caterpillars etc.

The agriculturist therefore will do well to encourage these beneficial birds in all possible ways and not tolerate the indiscriminate destruction of all birds either for sport or food. In areas badly infested with pests, perches may be supplied to useful birds in different parts of the field and for aquatic birds like ducks, etc., plenty of water may be let into the paddy fields to help the birds do their work actively. Such encouragement of useful birds is effected in many countries both by legislative and active measures. The killing of certain birds during particular seasons is prohibited. Useful birds are given nesting places and protection from enemies in the vicinity of cultivated areas.

An Experiment on the Introduction of Agricultural Improvements in villages on a mass scale.

By M. A. BALAKRISHNA AIYAR, L. Ag.

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Introduction. In a vast country like ours where conditions of soil, season, social customs and habits differ very widely from place to place, it is difficult to formulate a set of rules for universal application. Very wide general principles may be set down, but in their practical application, they must necessarily be modified to suit local conditions. The fact that the personal element, in the working of any scheme counts largely for its success or failure, has to be strongly emphasised.

In the scheme of work of the several development departments of the Government, the ultimate aim is to improve the condition of the rural population in all its aspects. The existing machinery for the purpose is inadequate and the results so far achieved are not obvious to people outside the departments concerned for the reason that they do not see the improvements all at one time and at one place.

In so far as the Agricultural Department is concerned a number of problems pertaining to cultural, varietal, manurial and other items are being tackled in the various Agricultural Stations and the results demonstrated to the ryots in the villages. But the extensive nature of the country, the absence of sound organisation among the ryots themselves, and more than all, the apathy of the ryots and their general dogmatic hold of the theory of fatalism are serious handicaps to orderly progress and uplift. The benefits of introducing a new strain in one village and the application of better cultural and manurial methods in another are not often known in other villages. Logical and progressive improvements are not to be seen and there is on the other hand stasis of a chronic type. For instance, in the North Arcot District some 20 years ago, ryots were growing soft-rinded striped canes. They were spending Rs. 20 to 30 worth of fuel to manufacture jaggery from an acre of cane. The Agricultural Department introduced a Java cane—247 B, and demonstrated a very efficient furnace for the preparation of jaggery, eliminating completely the use of wood as fuel for the purpose. Cane trash and megass alone were used as fuel in the new furnace for making jaggery. Incidentally other improvements like better methods of planting, manuring etc., were also demonstrated and ryots stood to gain up to Rs. 50 an acre, by abandoning their local cane and the old methods of cultivation and manufacture of jaggery. Even after two decades there are still some growers who adhere to the old wasteful methods. This shows that converting every ryot to new methods and ideas is not so easy as may appear on the surface. Traditional methods of cultivation filtered through ages are the ryots' stand-by. He often refuses to move forward and keep pace with the progressive elements to benefit himself. There is a constitutionally deep-rooted apathy.

The Single Village System. Considering the various limitations and the magnitude of the problem, the idea of tackling the problem in one village was taken up at the instance of the present Director of Agriculture. The village of Unai, in Vellore Taluk was selected for the purpose. A Demonstration Maistry was posted there and work was started on 1st March 1938. An association of the cultivators of the village as also of the neighbouring villages was formed with 47 members on the rolls. The work done there during the first 15 months is now reviewed.

The local agricultural practices and the possible improvements thereon were considered and in consultation with the members, it was decided to take up the following agricultural improvements. (1) Sowing *kolinji* (*Tephrosia purpurea*) for green manuring of all the single crop wetlands. (2) introducing Coimbatore seedling varieties of canes like Co. 281 and Co. 419 and adopting the cultural and manurial improvements in the cultivation of canes advocated by the Agricultural Department and (3) replacing the local *Chinna Samba* and *Sornavari* varieties of paddy with Co. 2 and Adt 12 paddy strains evolved by the Department. The aim throughout has been to make all the cultivators of the village and adjoining villages affiliated to the Association, take up the improvements in the cultivation of the

two major crops—paddy and sugarcane. Seven acres of *kolinji* for green manure, 3 acres of sugarcane varieties, 3 acres of Co. 2 and Adt 12 paddy strains were raised in the centre in 1938. During that year the rainfall was only half of the normal precipitation during the cropping season and the departmental methods introduced clearly demonstrated to the ryots that they stood to benefit by adopting them. The strains introduced resisted the drought extremely well.

The second season of activity has just commenced. As a result of intensive propaganda and demonstration done during the first season, the improvements taken up now in the block, compare favourably with those of last year. The block comprises the villages of Reddiyur and Unai, which are the main centres of activities of the Association.

Progressive areas under the improved crops.

Crop.	1938			1939		
	Quantity	Area in acres.	No. of ryots.	Quantity.	Area in acres.	No. of ryots.
Kolinji.	300 lb.	7	4	2,000 lb.	70	20
Sugarcane Coimbatore varieties.	35,000 setts.	3	3	2,00,000 setts.	45	37
Co 2. paddy.	75 lb.	2	2	1,640 lb.	40	24
Adt 12 paddy	34 lb.	1	1	500 lb.	10	7

It is seen that there has been considerable progress and that the ryots are following the improvements advocated by the department. The ryots would have purchased more of cane and paddy seeds and increased the area further this year but for the limited availability of seed at the time.

Other items of agricultural improvements were also demonstrated and adopted by the members of the association as well as by the non-members resident within the association area and the neighbourhood. They are :—

Purchase of ploughs ...	36
Green manure seeds other than *kolinji* ...	477 lb.
Seed coconuts	143
Cholam seed for fodder ...	60 lb.
Poultry (Rhode Island Red)	4
Spraying dusting etc. ...	20 gardens.
Circular water lift ...	1
Fish manure etc. ...	16 tons.
Paddy varieties other than Co. 2	500 lbs.
Breeding bull	1
Manure pits & dry earth sheds kept in good condition	70

The original idea of the Director of Agriculture, Madras, was to ascertain the possibility of making the whole village take to the agricultural improvements. The scheme has been highly beneficial to the cultivators of the centre. The first year's work is full of promise and the end of the second year is likely to see tangible results. There would then be evidence of many-sided improvement. The man in the street does not recognise that there is only one demonstrator for every taluk with about 300 to 500 villages

and hamlets so that it is not possible to meet the needs of more than a limited number. Nor does he realise that the ryots do not readily take his advice and that in every case the demonstrator has got to see him a number of times before he could be induced to take up even a single item of improvement. That is not all. The demonstrator is sometimes looked upon with suspicion by the un-enlightened ryots. They imagine that the Government are employing the demonstrator ostensibly for effecting improvements in ryot's cultivation, but really with the object of increasing their land assessment.

There are about 200 *pattadars* here cultivating the lands themselves. Forty persons in the Unai area have so far been made to take up the improvements and there are about 160 more ryots who have to be brought round in the course of the next year. After that a maistry to be in close touch with the ryots as at present would not be necessary, for by that time the centre would reach a stage at which further propaganda would be wasteful.

An attempt is made below to compute the money value of the improvements so far carried out and the extent to which the members have gained by the formation of an organisation like the present one.

Kolinji	70 acres at	Rs. 5	of extra profit an acre	Rs.	350
Sugarcane	45 ,,	Rs. 15	,,	Rs.	675
Co. 2. paddy	40 ,	Rs. 3½	,,	Rs.	140
Adt. 12 ,,	10 ,,	Rs. 2	,,	Rs	20
			Total	Rs.	1,185

Other improvements mentioned earlier could be valued at Rs. 800 or so of extra profit for the ryots in this centre. When all the ryots here follow the suggestions made by the Agricultural department, they would be benefitted to the tune of nearly Rs. 10,000 in an year.

Though it may be possible to make the ryots take up agricultural improvements on a mass scale in a general way, it may also be stated here that it would not be possible to convert all the hundred per cent of the people. Many ryots lead a precarious existence and do not possess the where-withal to meet the cultivation expenses, the cost of seeds, manures etc. Their cultivation methods are primitive.

Supply of improved seed. The supply of pure seed in sufficient quantities is intimately bound up with the question of mass scale introduction of agricultural improvements. The variety that is used in the early season may be found unsuitable for the late season. If the seeds of both early and late varieties are stocked in quantities sufficient to meet the needs of all the ryots, either the one or the other would be left over unused as seed and may have to be sold later for consumption at a lower rate. The demand for seeds is influenced by the market to some extent If the price of jaggery should shoot up during the sowing season, there would be a demand for sugarcane setts, which may exceed the normal demand by

more than 3 or 4 times. It would indeed be difficult for a seed supply organisation to accurately forecast the demand for seeds well in advance, as it is subject to wide fluctuations caused by erratic markets and seasons.

Recently the Hon. Mr. C. Rajagopalachariar, the Premier has suggested that two suitable centres may be selected in each circle, and that the various improvements advocated by the department may be introduced in these centres on a mass scale, to guage the extent of economic uplift possible in these centres. The preliminary work done at Unai and the results obtained there, would, it is hoped, serve to encourage the demonstrators who may be called upon to work similar schemes. It is a new type of work, but that need not be less encouraging on that account.

SELECTED ARTICLE

The Scientist and The Farmer.

By Professor E. R. Hudson, Director of Canterbury Agricultural College, Lincoln.

Before dealing with particular instances of the way in which science is applied to agriculture it may not be out of place to dwell on some of the result now in evidence. Of outstanding importance is the fact that the fear of famine no longer exists. In these days when food stuffs are produced in abundance, and sometimes even a super-abundance, it is easy to overlook the fact that only a short time ago, historically speaking, widespread shortages of food were not uncommon. Science, as applied to agriculture, has removed one of the greatest fears which beset mankind. Not only are we producing our foodstuffs and similar requirements in greater quantities than ever before, but we are doing so with many less workers, and today, in most countries, the rural population is proportionately much smaller than in the past. In the primitive England of 1086, 76 per cent. of all the men were engaged in agriculture. In the United states of America in the 70 years from 1850 to 1920, the number of rural workers dropped from 56 per cent to 26 per cent of all occupied persons.

Such changes, brought about by the application of modern methods — practically all due to science — are of tremendous significance. Now, to a greater degree than ever before in the history of the human race, the securing or producing of food has ceased to be the all-absorbing task of the majority of able-bodied men. For this reason the race is now free to move forward to the development of a standard of civilisation and of culture never before possible.

It is true that in the past certain groups of people, through specially favourable conditions, were able to provide themselves with a reasonably well assured and abundant food supply. Food-getting became an activity which did not occupy the full attention of the bulk of the people. It was under such conditions that civilisation developed and the fine arts and culture found a place. The valley of the Nile when occupied by the Ancient Egyptians is an instance of this.

In general, and throughout the world's history, advancement took place only in those regions where the problems of procuring food were at least partly solved.

On the other hand, in those areas and in those periods when the obtaining of a sufficiency of food was a serious difficulty, little or no advancement was made. The lessons of history would indicate that, through assuring us of an abundant food supply, the application of the physical and natural sciences to agriculture has opened the door to a new world, and the race is now free to move forward to the development of a standard of civilisation which was never before possible.

This new world is ours to mould as we may. It is in our power to make it a heaven or a hell, and today we must admit that the one seems scarcely less likely than the other. Without labouring the point further, we can realise that the ease with which food and other raw agricultural products are now obtainable marks a fundamentally important stage in progress, but it is doubtful whether the average person realises to what extent existing conditions are made possible only through the application of science. For instance, we are all prone to overlook the fact that our modern machinery, which is playing so big a part in agricultural production today, is the outcome of the work of the physicist, the chemist, and other scientists. The fuel for our machines, the steel and other alloys of which they are so largely constructed, the rubber used for tyres and other parts, the paint which protects them from corrosion, and a hundred other things which are involved in their production and their functioning are the indirect products of the laboratory The very homes in which we live are largely the indirect output of the scientist, and without his pioneering work modern buildings on the farm or elsewhere would not be available. Think for a moment of the importance of cement, of galvanised iron, of glass in such buildings.

One could give an almost unlimited number of examples of the way in which modern life is influenced by, and is dependent upon, the scientist. He is constantly evolving new materials and new methods which are adopted by industry and soon become accepted as a matter of course. Many of us do not realise that the scientist has been almost entirely responsible for shaping the world as we know it today. Let us now consider in greater detail some of the methods by which the scientist more directly influences our agriculture. It is difficult to know where to start, but to begin with we may consider a thing which greatly puzzled the ancients. It is possible to take a tub of soil, plant the seed of a tree in it, and, by adding nothing but water, produce a plant, the bulk and weight of which are many times greater than those of the soil in which it is rooted. What is the plant made of and how does it grow ? Careful scientific inquiry has supplied the answer. Today we have a full understanding, although not a complete knowledge, of plant growth and nutrition — important matters when we consider that all animal life, including that of ourselves, is dependent upon plant life The scientist has discovered that the bulk of the plant is derived from the atmosphere, but that certain small quantities of minerals must be derived from the soil.

These minerals are essential to plant growth, and if not available in sufficient amounts the growth is limited or, as the farmer would say, the crop is a failure. The chemist and the plant physiologist have studied the mineral requirements of our plants. We know what substances are liable to be deficient in certain soils. In New Zealand, as every farmer knows, we have a pronounced lack of phosphates, which we correct by applying phosphatic fertilisers — an everyday practice carried out by almost every farmer, who seldom pauses to think of the many years of scientific work which he calls to his aid when he applies superphosphate with his seed. One hundredweight of this fertiliser contains some 20 lb. of phosphoric acid, and is applied to an acre of soil, the upper 6-inch layer of which weighs approximately two million pounds. What the farmer does when he drills one hundredweight of super per acre is to apply to the soil 10 parts per million of phosphoric acid. Those 10 parts often represent the difference between a good and a poor crop, and sometimes the difference between a good crop and no crop at all. As with phosphates, so with many other plant foods. In some localities potash must be applied , in others, manganese. Cobalt may be lacking in another soil, and its deficiency is made evident in the losses which result among the animals grazed on such land. Borax is sometimes found to be necessary to ensure healthy plant growth. Only the scientist can solve the riddle of the deficient element.

The scientist does not work only in the laboratory. You will find him in the field conducting plot trials or examining the health, growth, and development of animals grazed on differentially treated areas. You may meet him in an office referring to statistics and examining records, pursuing every avenue which may lead to new knowledge. His tools of trade are not confined to the test tube and the microscope. Agriculture owes a great deal to the physicist, the scientist devoted to the study of matter and of energy. I have already referred to the influence of machines on modern life and modern methods of production. We are prone to give credit to the engineer for such machines, but behind the engineer is the physicist as well as the chemist. The engineer applies the knowledge gained by the scientist, just as in turn the farmer may use a tractor produced by the engineer. To the physicist we owe our knowledge of hydraulics, which we use in our drainage schemes, in our water supplies, and in our irrigation projects. He also has given us refrigeration. His studies of centrifugal force led to the production of the cream separator and the milk and cream tester. He gives us our electric light and power, as well as the magneto or the induction coil which is an integral part of our petrol engines.

No physicist of even a century ago could possibly have foreseen the many ways in which the knowledge he was painstakingly acquiring has been of benefit to mankind. The true scientist is concerned primarily with the discovery of new knowledge. Its application is a secondary consideration about which he is not so vitally concerned. Michael Faraday, one of the greatest of physicists, was one day working in his laboratory on what was a new discovery. He found that by turning a loop of wire in the space between two magnets an electric current was generated in the wire. At the time a lady visitor was being shown through the laboratory and Faraday, over-flowing with enthusiasm, explained to her what had just been discovered. "Yes", said the lady, "but, Doctor, what is the use of it?" "Madam", replied Faraday, "what is the use of a baby?" Faraday's "baby" has grown into a husky adult. On his discovery is based the construction of the electrical equipment which is used so freely today.

The layman often imagines that the botanist is concerned only with the naming and classification of plants. That is but a small part of his work. Of much greater importance is his study of plant growth. The systematic production of new types of plants and the selection of improved strains is a comparatively recent but most important development following upon the publication of the work of Mendel and upon a fuller understanding of genetics. The economic importance of applied botany would be difficult to over-estimate. Practically all of the crop plants grown today are the result of carefully controlled breeding and selection. As an example, it may be mentioned that in New Zealand by far the greater part of our wheat crop is produced from seed selected or specially bred at Lincoln. The yields have been increased, and the quality improved. Similar work is being done with a number of other crops and pasture plants. The result of such work is that, without additional cultivation or extra manuring, the farmer harvests a bigger crop and one of better quality.

Crop plants are subject to damage from various parasitic plants, especially fungi, and these low forms of plant life are liable to take a big toll. Their study forms the branch of botany known as mycology, and the mycologist contributes much to modern agricultural practice. In association with the plant breeder he produces resistant or immune varieties of crops. He has developed various steeps and dust which, if used on the seed, destroy the spores of the parasite. He has developed sprays and dusts for the direct control of other fungus parasites, and more recently he has undertaken an attack, as yet only partially successful, upon the newly recognised but widely distributed virus diseases of our cultivated

plants. The various branches of zoology have thrown light on many problems associated without animals and plants. The entomologist wages war against what is probably mankind's most serious enemy—insects. He has studied their habits and their life histories, and selects the weak points for his attack. He has developed insecticides of various types—sheep dip is a case in point—and he introduces one insect to prey upon another. The introduction of a parasite for the white butterfly will suggest itself as a well-known recent example.

The helminthologist devotes his attention to parasitic worms of various kinds, and in this branch of science steady progress is being made. Consider the story of the liver fluke, a parasitic worm which, fortunately, is not common in New Zealand, but which in the past resulted in large losses of sheep in other countries. Only the painstaking scientist was able to master it, and first he had to understand its life history. The eggs of the worm, when voided by the sheep, do not re-infest another sheep. After hatching, the young worm proceeds to parasitise a water snail, in which it develops into a form different from its parent. Its young parasitise the sheep. By destroying the snail the disease of the sheep is controlled. The new examples which I have brought to your notice may suffice to illustrate how dependent is modern agriculture upon the scientist. But the scientist cannot replace the farmer, and in some ways agriculture is not a science and never can be. It is an art.

The farmer may call to his aid all the scientific knowledge and modern equipment available, but he can never standardise his methods or his work. He lives too close to Nature for that. He has to contend with an ever-changing set of conditions. The hand of the agricultural clock rotates but once a year, and never are conditions the same in any two seasons. So long as we have variation in rainfall and other seasonal conditions, just so long will the art of agriculture be of outstanding importance. Science will remain a useful handmaid, but will not be the master of the competent landsman. *New Zealand Jour. of Agri.* 59: (1939) 121—126.

ABSTRACTS

Extraction of Saponin from Soap Nut. By J. L. Sarin and M. L. Beri, *Indus. and Eng. Chemistry*, 31 : 712. An efficient and commercially practicable method has recently been worked out at the Government Industrial Research Laboratory, Lahore, for the extraction of saponin from soap nut, a raw material which is found abundantly in India. The extraction of saponin from this source had not hitherto been possible on a commercial scale.

The soap nut selected for extraction was from the *Sapindus mikorossi* species and consisted of 56·2 per cent. pericarp and 43·8 per cent. seed. The pericarp, in which the saponin occurs, was sun-dried, powdered and extracted with ethyl acetate. The extract, on distillation, yielded crude saponin which was purified by dissolving in water and adding a solution of barium hydroxide. The precipitated barium salt of saponin was suspended in dilute alcohol and decomposed by carbon dioxide into barium carbonate and saponin. The saponin solution was evaporated and the resulting saponin recrystallised from ethyl alcohol. The yield was 30·31 per cent. on the weight of the pericarp and 17·17 per cent. on the weight of soap nut. This yield is higher than has been obtained from any other known saponin-yielding plant.

The soap nut saponin prepared could be utilized for the same purposes as saponin from other sources, e.g. as an emulsifying agent for vegetable and essential oils, as a foam stabilizer, in the manufacture of soapless shampoos and to increase the spreading power of sprays upon foliage—Abstract in *Tropical Agriculture*, 16 (1939) : 219.

Storage of Tropical Fruits—C. W. Wardlaw. *Nature* Vol. 144 pages 178—18-1939. Success in transporting fruits and vegetables does not depend on refrigeration alone. It has become necessary to investigate at least in part related biological aspects such as the physiological behaviour of different varieties questions of harvesting maturity, optimum conditions for harvesting, pre-storage and disinfectant treatments, the effect of different methods of wrapping and packing, post-storage treatments including ripening technique and wastage problems in general.

Tropical fruits have to be kept at suitably how temperatures to prevent rapid ripening and onset of wastage. The fruits have to be rapidly cooled and carried in cool storage (avocado 45°F., mangoes and tomatoes 47·5°F.) grape fruit, orange and lime 45°—50°F. Gros Michel bananas 53°F. Congo and Lactan bananas 56°—58°F., papayas 60°F.) if chilling injuries are to be avoided. Exposure to too low temperatures results in blemishes, failure to ripen and loss of resistance to fungal attacks.

Maintenance of correct humidity relationships within storage rooms or holds is of considerable importance. Relative humidity should not be so low as to allow serious loss in weight or modify the apperance and maturation of the fruit during storage period nor so high as to promote growth of fungal hyphae. Localised condensation within the congo sack must be avoided.

Bananas. The major aspect of banana investigations has been centred round the evolution of a variety to replace Gros Michel—which is best suited for storage and transport but is highly susceptible to the Panama disease. Two varieties I. C 1, and I. C. 2 have been evolved in Trinidad but the former has occasional seeds 1. C. 2 is very promising The optimum harvesting maturity lies between '¾ full' and 'heavy ¾ full'. Thin grade fruit is difficult to ripen. 'Heavy ¾ full' fruit behaves well at 53°F. but ripens with an excessive odour of pear drops. During recent years a leaf disease due to *Cercospora musae* causes premature ripening and reduction in size of fruits. This has introduced complications in the storage problem.

Limes. Humidity is an important factor in storage of limes. Speedy handling, protection of fruits by suitable wrappers and rapid cooling to 45°F. are essential to the successful storage of this fruit. As with other citrus fruits limes are subject to superficial blemishing known as 'Obocellosis' resulting from mechanical injury to turgid fruits. To avoid this fruits should not be picked too early in the morning or too soon after the fruits have been covered with rain or dew.

Grape fruits. Unexpected results have been obtained in Trinidad. Thus when fruit is treated with borax solution before crating to prevent mould, the, activities of *Colletotrichum gloeosperoides* are promoted. Iodised wraps also produce similar effects. Variations in keeping quality, susceptibility to chilling and to fungal disease are apparent in fruits from different localities.

Avocadoes. A distinctive feature of avocado is its high fat content. Most of the West Indian varieties are intolerant of temperatures below 50°F. In avocado maturation slowly continues even at relatively low tempe atures so that fruits ultimately become ripe. Only a few varieties combine requisite commercial qualities with adequate cold resistance.

Mangoes. These are readily subject to low temperature injury but it varies with variety, maturity at harvesting and season. Exposure to temperatures below 48°—50°F. results in chilling injury, superficial blemishing being accentuated by partial dessication. The wastage problem in mango storage is serious. Most of the fruits carry latent infections and these increase wastage due to

chilling, slow ripening and tardy distribution of ripe fruit. The high incidence of field infections directs attention to orchard sanitation.

Papayas. Little progress can be made in commercial storage until standardized supplies of fruit are available The basic problem is to select and perpetuate good types from material which is notoriously variable. Trials show that immature papayas will not ripen after cold storage and most of the varieties show evidence of chilling if held below 55°—60°F.

Tomatoes. When picked full grown but green Trinidad fruit can be kept in cold storage at 40°—47° F. for 20—23 days and on removal to a higher temperature remains in good condition for 8—10 days. This is in marked contrast to the results on fruits grown outside the tropics. Trials at the Low Temperature Research Station at Cambridge showed that autumn fruits had poor keeping quality while summer fruits are more tolerant to low temperature.

T. S. R.

The present and the future of the Lime Juice Industry in India. S. S. Bhat *Agriculture and Live-stock in India.* The acidity of the juice ranges from 5 to 7·5 with the season, which makes it partially self preserved. The juice gets stale however, on storage. The addition of potassium metabisulphite, a useful and harmless preservative, in the proportion of 1 in 3,000 (2½ grains to a pound) preserves the juice. The discolouration of the juice is also prevented thereby. Bottling the juice, pasteurising it by immersion in a water bath with a false bottom at 70°C for half an hour, sealing and storage in a dark cool room which preserves the juice properly is advised. Cleanliness and asepsis are to be observed right through. Highly refined cane sugar may also be dissolved in the cold juice before pasteurisation. The addition of lime juice to sugar syrup and the boiling of the mixture and bottling is the general method of making lime juice cordial. The boiling takes off the fresh flavours, the full nutritive value and the natural colour of the product. The cordial gets brownish on boiling and darkens on storage. Lime juice may be mixed with juice of oranges and other citrus fruits and sugar and pasteurised, if desired. The presence of fruit cell matter in the bottled product gives an attractive appearance. The bitter taste and flavour of the lime rind oil helps to flavour the preserved product and to give fragrancy to the juice. The possibility of manufacture of lime juice in India, the production and demand, the problems connected with factory production, storage and marketing and finally the limiting factors are discussed. *V. T. S.*

Spraying with plant growth substances to prevent apple fruit dropping: F. E. Gardner, P. C. Marth, L. P. Bartijer—U. S. Horticultural station, Bureau of plant Industry, Beltsville, M. D.—*Science.* 90: (1939) 208—209.

The late fruit drop of apple occurs in many apple varieties and other fruits just prior to and during harvest time and annually results in substantial losses. This fruit drop is, in general, a characteristic of early ripening varieties, but is also of frequent occurrence in a number of important midseason and late apples. As the fruit approaches maturity the danger of fruit dropping becomes more acute. In some varieties the fruit drop is sudden and disastrous while in some others it occurs steadily for several weeks prior to harvest.

Climate and weather are known to be important factors determining the feasibility of growing certain varieties in a given region.

Most of the commercial plant growth substances have the propensity, in varying degrees, of delaying the normal abscission of various plant organs. Among these naphthalene acetic acid and naphthalene acetamide have been reported as being particularly effective in delaying abscission of flowers of the date and holly. This property was made use of with more than gratifying results

to the problem of apple fruit drop by spraying the trees with the above named compounds.

Napthalene acetic acid and Naphthaline acetamide applied just prior to fruit maturity have proved to be particularly effective. Trials with indole acetic acid and indole butyric acid indicate that these indole compounds are much less effective than the naphthalene compounds.

A dilute concentration of 0·001% naphthalene acetic acid sprayed on Williams Early Red showed that in a fortnights' time the fruit drop in the sprayed trees was from 10·3 to 1·5% of the total crop whereas in the unsprayed trees the fruit drop was from 64·2 to 90 8%. Concentrations of ·00025% on other varieties have been found to bring about very marked inhibition of dropping. More experiments are carried on with addition of these compounds to the regular spray schedule. *S. K.*

EXTRACTS

Rat control. Of the common rat poisons investigated—thallous sulphate, yellow phosphorus, the alkaloid strychnine, zinc phosphide, red squills, white arsenic (As_2O_3) and barium carbonate it is considered that all but the first three can be discarded as unsuitable for Queensland Cane field conditions.

The foods which have been used for bait bases can be listed in order of preference by the rats as follows :—rolled oats, cracked corn, whole corn, wheat meal, whole wheat, barley and bread. Rolled oats stand out above the others ; there is very little difference between the next four, barley is not a food particularly desired by the field rat and there is always a very poor intake of bread.

It has been found that thallous sulphate and the alkaloid strychnine should not be used on bread, but it would be uneconomic and unnecessary to use phosphorus on a base other than bread unless an even cheaper bait base were available. The intake of thallous sulphate-treated grain decreases with bait strength. It is considered that under present methods of distributing thallous sulphate-treated grain in Queensland Cane fields i. e. in packet form—a bait strength approximating to 1 : 300 would be most economical.

The unsoundness of using "take" as a criterion for comparing the effectiveness of different poisons, baits or bait-strengths in the field has become evident. Thallous sulphate-treated wheat (1 : 500) usually exhibits a comparatively large intake per rat while phosphorus on bread is not particularly attractive to the pests. Nevertheless. it has been found that. in reducing field populations balit, with its extremely high toxicity, has about the same effect as an excellent take of the less toxic thallous-sulphate-treated wheat. It would appear that the addition of linseed oil to poison bait is unnecessary. (*Inter. Sugar Journal ;* Vol. XLI, No. 486, p. 236, 1939.)

Extermination of white ants. All are familiar with the damage done by white ants, which are not really ants but termites. They live in colonies very similar to ordinary ant nests. The worker termites build the nest and forage for food, and they are equipped with very strong jaws with which they do the characteristic damage to timber. They alone are responsible for the damage. They are blind and have no sex. The soldier caste of termites protects the others from the attacks of small black ants which are their natural enemies. At certain times of the year the workers open the galleries normally sealed from the open air and let out winged males and females which fly off and on settling lose wings and begin new colonies.

Termites commonly eat their dead, also they have a habit of grooming each other, which consists of licking their bodies, and these habits make it possible to poison them.

The Council for Scientific and Industrial Research has done much valuable research work on the habits of termites. Termites derive their main food from the wood which is digested by the workers. It has been found that they do not generally attack wood deeper than one foot below the surface of the ground. They are able to build tunnels across brick, concrete or metal in order to get at timber floors above. Termites can digest lime water and have been known to travel right up through a wall built in lime mortar to attack timber in the roof above. Once white ants have been found in timber and the galleries which lead back to their nest broken into, they will leave that piece of timber unless very massive, and break out in another direction. The Council for Scientific and Industrial Research recommends great care in locating their tunnels, which should be bored and white arsenic blown in by means of an insect powder blower. The hole should be plugged. The worker ants will then carry back to the nest minute quantities of arsenic, which will in a month or so destroy the whole colony. The process is not rapid but it is certain. Where mounds are accessible, as in the open, a hole should be bored well down into it and about ½ oz of arsenic blown in, and the hole plugged. Investigators have found that as small a quantity as 1/16th of an ounce will destroy complete colonies in a year, but 1/8 oz. will destroy them in 3 months. Half an ounce was found to completely destroy the colony in one month, and since arsenic is cheap the latter dose is the most economical. Half an ounce is two level teaspoonsful. I have found this method most effective and members can try it if they are troubled with white ants, with confidence and at small expense. *Jour: Dept. Agr. S. Australia* 43 (1939): 49.

Gleanings.

Digestibility of Straw. Straw contains large quantities of carbohydrates which can be only partially digested by farm animals. Various attempts have been made to increase the digestibility of straw by some pre-treatment.

In the course of an investigation of the problem, oat and wheat-straw were treated with caustic-soda solutions of varying strengths and for varying lengths of time.

Best results were obtained with a 1·25 per cent solution and an immersion period of 20 to 24 hours without heating. With the volume of solution used, this represented 10 pounds of caustic soda per 100 pounds of straw. The starch equivalent per 100 pounds of straw was more than doubled by the treatment.

Treated oat-straw fed to fattening bullocks resulted in a daily livestock gain of just under two pounds over a period of 62 days.—*Nature.* Reproduced in (*Scientific American.* Vol. 161. No. 3, p. 161).

A New Wood Preservative. An American patent (Am. P. 21,49,284) by A. Gordon, Berkely, Cal., U. S. A., describes the composition of a new wood preservative. According to the details contained in the Deutsche Bergwerks Zeitung (No 178, Aug. 1939), 63·2 kg. of copper sulphate crystals ($CuSO_4 . 5H_2O$) are dissolved in 200 kg. of water; the copper is precipitated by the addition of caustic alkali obtained by dissolving 20·224 kg. of sodium hydroxide in 50 kg. of water. The precipitate is dissolved in an ammoniacal solution (17·75 kg. of ammonia in 1000 kg. of water) and to this solution of cupric ammonium hydroxide is added 21·2 kg. of "arsenic" (presumably the pentoxide) and 0·6 kg. of ferric acetate. The preservative thus obtained can be diluted with (up to) three parts of water. It is claimed that wood impregnated with a solution of this composition would retain the copper and arsenic in insoluble (and therefore unleachable) forms and thus remain immune to the action of wood-destroying organisms. *Current Science* 8 (1939): 436.

Indian Drugs for Treatment of Cattle. The Imperial council of Agricultural Research has sanctioned three schemes, at a cost of over a lakh of rupees, for research in Indian drugs to be used in the treatment of cattle. The schemes will cover investigations into the cultivation of medicinal plants, the efficacy of indigenous drugs and the indigenous treatment of cattle.

Lt. Col. R. N. Chopra, of the School of Tropical Medicine, Calcutta, has been granted Rs. 62,860 for a five years' scheme. The researches under this scheme cover the survey of medicinal plants which can be grown in India, chemical analysis of their pharmacological and therapeutic action and an investigation of food poisons, particularly in cereals.

The second scheme which will be a study of poisonous plants and of their doses required in veterinary practice, will be controlled by the Surgeon-General of Madras. This will be a three years' scheme and will cost Rs 39,000. The object of the scheme is to examine how far indigenous drugs can take the place of the imported ones.

The third scheme sponsored by the Premier of Orissa, is for the collection of literature about cattle treatment by indigenous drugs. It has been sanctioned initially for a period of six months at a cost of Rs. 4,500. Information from manuscripts and other sources is being collected and collated.

As two of these three schemes are veterinary, they will be correlated to the comprehensive survey of cattle diseases already being made by the Imperial Veterinary Research Institute, Mukteswar, through the Veterinary investigation officers. (*Current Science* Vol. 8, No. 9).

Correspondence.

To

The Editor, Madras Agricultural Journal.

I. A device for scaring birds.

Sir,

The damage to cereal crops by birds at the time of grain ripening is known to be considerable and various devices are in use in different tracts to minimise this loss.

The care-crow, the boy scarer, the use of empty tins and pop guns deserve particular mention.

The scare-crow either in the shape of pie-bald spotted old earthern pots or in the guise of stuffed bizarre human figures with a watchman's proverbial stick are more intended for immunity against 'evil eyes' than actual frightening of the bird visitors.

The boys employed to sit on watch on improvised raised platforms in the centre of the fields with slings and stones, or empty kerosene tins, or both are fairly effective. They make sufficient noise by shouting and beating the drum and by pelting the visiting groups with stones. They in addition serve as day watchmen.

At Adoni, and in many parts of the Ceded Districts, an explosive mixture made out of chlorate of potash and sulphur is in use for this purpose and the simulation of a sound like gunshot appears to be ideal as a device for scaring birds. The method and its economics are given below for the information and benefit of ryots in other tracts and is recommended for a wider adoption on account of its efficiency.

The *dimmi* as the device is called, consists of a hollow iron cylinder about two to three feet long and ¾ inch broad, soldered to a cup about one inch thick at the bottom. There is a small opening at the side of the cup through which

the explosive powder is introduced into the cylinder. An iron rod with a T handle which runs into the cylinder when acted upon, causes an explosion with a loud report.

The initial cost of the *dimmi* will be about Rs. 2. The explosive mixture costs annas twelve a seer and this quantity, when judiciously used, will last for a month. Old unused pipes cut to size and closed at one end are quite handy.

Cotton Breeding Station, Adoni, Nov. 5, 1939. } Yours &c., K. Raghavan.

II. The use of Guntakas in puddling rice fields.

Sir,

The *guntaka* or blade harrow is well known in all tracts in our country, where the seed drill is in use. It is used for a variety of purposes in dry lands, e. g. covering seed, stirring soil, harrowing and intercultivating crops. But its use in puddle may be a novelty and hence this note. Normally five ploughings are given to wetlands before rice is sown or transplanted in puddle. With the use of this implement three ploughings can be dispensed with and a saving of Rs. 2 to Rs. 3 per acre effected in preparatory cultivation depending upon the tract. Trials were made with H. M. Guntaka No. 2, No. 1 and No. 0. The local *guntaka* (wooden body and iron blade) also was used. In heavy soils, lighter guntakas such as No 1 and No. 0 will be more suitable. For growing rice under puddled conditions inversion of soil is not of much consequence. When this *guntaka* is worked after one or two ploughings with the country plough the unploughed land left between the furrows is also cut and a homogenous puddle is obtained. I shall be glad if some readers of your Journal would try this implement for puddling and record their experience for the benefit of others.

St. Thomas Mount, Nov 12, 1939. } Yours &c. R. Swami Rao.

Agricultural Jottings.

(From the Director of Agriculture, Madras).

TIRUVOTTIYUR MILCH CATTLE MARKET

Madras, Friday the 14th October 1939.

The period of heavy arrivals of cows and buffaloes from the Ongole tract has commenced and the arrivals are nearly double of those of last week. Sales too have increased during the week as the quality of stock has improved, Prices, however, are steady.

The following gives the stock movements during the week ended 13th October 1939.

	Stock at commencement.	Arrivals during the week.	Sales during the week.	Balance.
Cows-Ongole	140	142	132	150
Buffaloes-country	220	218	186	252
Buffaloes-Delhi.	9	...	...	9

Prices.

Age.	Milk yield.	Prices ranging. From	To
		Rs.	Rs.
Cows-Ongole.			
1st and 2nd calving	2—3 Madras Measures.	70	90
	3—4 „ „	90	120
3rd and 4th calving	2—3 „ „	55	70
	3—4 „ „	70	110
Buffaloes-country.			
1st and 2nd calving	2—3 „ „	60	90
	3—4 „ „	90	110
3rd and 4th calving	2—3 „ „	55	70
	3—4 „ „	70	90
Others.			
Baffaloes-Delhi.		120	200
Cows-Cross bred.		150	200

Market Report No. 16.

Madras, Friday, the 20th October 1939.

The arrivals during the week were rather restricted compared to those of previous week. The market remained quiet throughout the week. The stock movements during the week ending 20th October 1939 were as follows :—

	Stock at Commencement.	Arrivals.	Sales.	Balance.
Cows-Ongole	170	72	91	131
Buffaloes-country	252	40	154	138
Buffaloes-Delhi	9	6	5	10

Prices.

Age.	Milk yield.	Price ranging From	To
		Rs.	Rs.
Cows-Ongole.			
1st and 2nd calving	2—2 Madras Measures	80	90
	3—4 „ „	90	120
3rd and 4th calving	2—3 „ „	55	70
	3—4 „ „	70	110
Buffaloes-country.			
1st and 2nd calving	2—3 „ „	60	90
	3—4 „ „	90	110
3rd and 4th calving	2—3 „ „	55	70
	3—4 „ „	70	90
Others.			
Buffaloes--Delhi.		120	200
Cows-cross bred.		150	200

Market Report No. 17.

Madras, Friday the 27th October 1939.

Owing to inclement weather the arrivals of stock were poor both in quantity and quality. The cattle market remained fairly steady though a slight fall in buffalo prices was in evidence. The stock movements during the week ended 27th October 1939 were as follows :—

	Stock at Commencement.	Arrivals.	Sales.	Balance at the end.
Cows-Ongole	131	77	108	100
Buffaloes-country	138	52	80	110
Buffaloes-Delhi.	10	...	5	5

Prices.

Age.	Milk yield.	Prices ranging From	To
		Rs.	Rs.
Cows-Ongole.			
1st and 2nd calving	2—3 Madras Measures	70	90
	3—4 " "	90	120
3rd and 4th calving	2—3 " "	60	70
	3—4 " "	70	110
Buffaloes-country.			
1st and 2nd calving	2—3 " "	55	80
	3—4 " "	80	100
3rd and 4th calving	2—3 " "	50	60
	3—4 " "	60	80
Others.			
Buffaloes-Delhi.		120	180
Cows-cross bred		150	200

Market Report No. 18.

Madras, Friday the 3rd November 1939.

Due to stormy weather in the Ongole area the arrivals of cows and buffaloes were extremely poor and as a consequence the stock of animals at the market is low. The prices, however, have not improved and the low prices of buffaloes continue. The stock movements during the week ending 3rd November 1939 were as follows :—

	Stock at commencement.	Arrivals.	Sales.	Balance at the end.
Cows-Ongole	100	38	76	62
Buffaloes-country	110	50	58	102
Buffaloes-Delhi	5	...	...	5

Prices.

Age.	Yield of Milk.	Prices ranging. From	To
		Rs.	Rs.
Cows-Ongole.			
1st and 2nd calving	2—3 Madras Measures	70	90
	3—4 " "	No stock	
3rd and 4th calving	2—3 " "	60	70
	3—4 " "	70	120
Buffaloes-country			
1st and 2nd calving	2—3 " "	55	70
	3—4 " "	70	100
3rd and 4th calving	2—3 " "	50	60
	3—4 " "	60	80
Others			
Buffaloes-Delhi.		120	160
Cows-cross bred.		120	180

Market Report No. 19.

Madras, Friday the 10th November 1939.

Arrivals of cows and buffaloes have improved over those of last week though they are still low. The market is dull but prices are steady.

The stock movements during the week ending 10th November 1939 were as follows :—

	Stock at Commencement.	Arrivals.	Sales.	Balance at the end.
Cows-Cngole	62	70	62	70
Buffaloes-country	102	74	66	110
Buffaloes.Delhi	5	...	2	3

Prices.

Age.	Yield of milk.	Prices ranging From	To
		Rs.	Rs.
Cows-Ongole.			
1st and 2nd calving	2—3 Madras Measures	70	90
	3—4 " "	90	120
3rd and 4th calving	2—3 " "	60	70
	3—4 " "	70	110
Buffaloes-country.			
1st and 2nd calving	2—3 " "	55	70
	3—4 " "	70	100
3rd and 4th calving	2—3 " "	50	60
	3—4 " "	60	80
Others.			
Buffaloes-Delhi.		120	160
Cows-Cross bred.		120	180

Crop and Trade Reports.

Statistics—Crop—Gingelly 1939—40—Intermediate condition report. The gingelly crop has been affected to some extent by drought in parts of Vizagapatam, Bellary, Anantapur, Nellore, Chingleput, Chittoor and Coimbatore and by an attack of insect pests in parts of Ramnad. The yield is expected to be normal outside these districts.

The wholesale price of gingelly per imperial maund of 82 2/7 lbs. (equivalent to 3,200 tolas) as reported from important markets on 6th November 1939 was Rs. 6—8—0 in Vizianagaram and Cocanada, Rs. 6—6—0 in Vizagapatam and Tinnevelly, Rs. 6—1—0 in Trichinopoly, Rs 5—11—0 in Rajahmundry, Cuddalore and Tuticorin, Rs. 5—9—0 in Ellore and Rs. 5—7—0 in Salem. When compared with the prices published in the last report, i. e. those which prevailed on 9th October 1939, these prices reveal a rise of approximately 6 per cent in Cuddalore and a fall of approximately 5 per cent in Trichinopoly, 4 per cent in Vizagapatam, Rajahmundry and Tuticorin and 2 per cent in Ellore, the prices remaining stationary at other centres

Statistics—Paddy—1939—40—Intermediate Monthly report. The harvest of first crop paddy is proceeding in East Godavari and has either concluded or is concluding in parts of the Central districts, the South and the West Coast. The yield is reported to be nearly normal in the West Coast and below normal in the other districts. The standing crop is reported to have been affected to some extent by insect pests in parts of the deltas of the Godavari. The condition of the crop is reported to be generally satisfactory in the other districts.

The wholesale price of paddy, second sort, per imperial maund of 82 2/7 lbs. as reported from important markets on 6th November 1939 was Rs. 3—1—0 in Madura, Rs 2—14—0 in Vellore, Rs. 2—13—0 in Trichinopoly, Rs. 2—12—0 in Chittoor, Rs. 2—11—0 in Virudhunagar, Rs. 2—10—0 in Vizianagaram and Rajahmundry, Rs. 2—9—0 in Ellore, Bezwada, Guntur and Tinnevelly, Rs. 2—8—0 in Cocanada, Masulipatam and Kumbakonam, Rs. 2—7—0 in Conjeeveram, Rs. 2—4—0 in Negapatam, Rs 2—3—0 in Hindupur, Rs. 2—2—0 in Cuddalore, and Rs. 2—0—0 in Anantapur. When compared with the prices published in the last report, i.e. those which prevailed on 9th October 1939, the prices reveal a rise of about five per cent in Conjeeveram, three per cent in Guntur and Tinnevelly and two per cent in Rajahmundry and Madura, and a fall of about five per cent in Hindupur and three per cent in Nagapatam, the prices remaining stationary in the other markets.

Statistics—1939—Crop--Groundnut—Intermediate condition Report. The condition of the winter crop of groundnut is reported to be generally satisfactory except in parts of Chingleput, South Arcot, Tanjore, Madura and Ramnad where the crop is said to have been affected to some extent by hairy caterpillar and "Surul".

The wholesale price of groundnut (shelled) per imperial maund of 82 2/7 lb. (Equivalent to 3,200 tolas) as reported from important markets on 6th November 1939 was Rs. 5--2 -0 in Cuddalore, Rs. 4-13-0 in Vizagapatam and Tadpatri, Rs. 4—12—0 in Guntur, Rs. 4—10—0 in Vizianagaram, Rs. 4--3—0 in Anantapur, Rs. 4-0-0 in Nandyal and Hindupur, Rs. 3...15...0 in Bellary, Adoni and Coimbatore and Rs. 3-14-0 in Cuddapah. When compared with the prices published in the last report, i.e., those which prevailed on 9th October 1939, these prices reveal a rise of approximately 6 per cent in Guntur, 3 per cent in Cuddalore and 2 per cent in Bellary and a fall of approximately 3 per cent in Vizianagaram, Adoni and Hindupur and 1 per cent in Vizagapatam, the prices remaining stationary in Nandyal, Cuddapah, Coimbatore and Anantapur.

Statistics—1939--Crop—Sugarcane—Intermediate condition report. The condition of the sugarcane crop is generally satisfactory except in South Arcot where the crop has been slightly affected by stem-borer in parts. The yield is expected to be normal in all districts outside Vizagapatam, South Arcot and North Arcot where it is estimated to be slightly below normal.

The wholesale price of jaggery per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 6th November 1939 was Rs. 9—5—0 in Adoni, Rs. 8—7—0 in Vizagapatam, Rs. 8—1—0 in Cuddalore, Rs. 8—0—0 in Rajahmundry, Rs. 7—14--0 in Chittoor, Rs. 7—7—0 in Salem, Rs. 7—6—0 in Cocanada, Rs. 7—4—0 in Vellore, Rs. 6—10—0 in Vizianagaram, Rs. 6—9—0 in Erode, Rs. 6—7—0 in Trichinopoly, Rs. 6—6—0 in Bellary Rs. 5--14—0 in Mangalore and Rs. 4--14—0 in Coimbatore, When compared with the prices published in the last report, i.e., those which prevailed on 9th October 1939, these prices reveal a rise of approximately 8 per cent in Vellore, 6 per cent in Vizagapatam, Adoni and Mangalore, 5 per cent in Chittoor and 3 per cent in Rajahmundry, the prices remaining stationary at other centres.

Statistics--1939--40—Cotton—Intermediate monthly report. In the Central districts and the South, the sowings of cotton are still in progress in parts, The area under the crop is expected to be normal or slightly above normal.

In the Deccan, the sowings of *hingari* or late cotton have concluded and the area is expected to be above normal. The crop has been benefited by the rains of October and is progressing well. The yield from *mungari* or early cotton in parts of the Deccan is expected to be slightly below normal.

The local cotton trade is not generally active at this time of the year. The average wholesale price of cotton lint per imperial maund of 82, 2/7 lbs. as reported from important markets on 6th November 1939 was Rs. 16—13—0 for Cocanadas, Rs. 15—10—0 for red-Northerns, Rs. 14—4—0 for white Northerns, Rs. 15--3--0 for Western (mungari crop) Rs. 17--3--0 for Westerns (jowari crop), Rs. 26—8—0 for Coimbatore Cambodia, Rs. 24—12—0 for Coimbatore-Karunganni, Rs. 23--10--0 for Southern-Cambodia, and Tinnevelly-Karunganni, Rs. 21—5—0 for Tinnevellies and Rs. 19—7—0 for Nadam cotton. When compared with the prices published in the last report, i.e. those which prevailed on 2nd October 1939, the prices reveal a fall of about four per cent in the case of Westerns (jowari crop) and Southern Cambodia, three per cent in the case of Cocanadas, Westerns (mungari crop) and Tinnevellies, two per cent in the case of Coimbatore-Karunganni and one per cent in the case of Tinnevelly Karuganni and Nadam, the prices

remaining stationary or practically so in the case of Coimbatore Cambodia and Northerns (red and white varieties).

Statistics—Cotton—1939—40—Second Forecast Report. The average of the areas under cotton in the Madras Province during the five years ending 1937—38 has represented 9·9 per cent of the total area under cotton in India.

The area under cotton up to the 25th September 1939, is estimated at 776,900 acres. When compared with the area of 833,200 acres estimated for the corresponding period of last year, it reveals a decrease of 6·8 per cent. The decrease in area occurs in most of the important cotton growing districts owing mainly to the want of timely and sufficient rains.

The area in the Central districts and the South relates partly to the last year's crop and partly to the current year's sowings which have commenced in parts.

The condition of the standing crop is generally satisfactory.

The average wholesale price of cotton lint per Imperial Maund of 82 2/7 lb. as reported from important markets on 2nd October 1939 was Rs. 17—5—0 for Cocanadas, Rs. 15—10—0 for Red-Northerns, Rs. 14—4—0 for white-Northerns Rs. 15—11—0 for Westerns (Mungari crop) Rs. 17—13—0 for Westerns (Jowari crop) Rs. 26—9—0 for Coimbatore Cambodia, Rs. 24—11—0 for Southern Cambodia, Rs. 25—4—0 for Coimbatore-Karunganni, Rs. 23—14—0 for Tinnevelly-Karunganni, Rs. 22—1—0 for Tinnevellies and 19—11—0 for Nadam Cotton. When compared with the prices published in the last report, i.e., those which prevailed on 4th September 1939, the prices reveal a rise of about five per cent in the case of Northerns (red and white) 12 per cent in the case of Nadam, 14 per cent in the case of Coimbatore Cambodia, 18 per cent in the case of Southern Cambodia, and 20 to 25 per cent in the case of the other varities of cotton. (*From the Director of Industries and Commerce.*)

Cotton raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 10th November 1939 amounted to 446, 651 bales of 400 lb. lint against an estimate of 388, 900 bales of the total crop of 1938-39. The receipts in the corresponding period of the previous year were 481,047 bales. 367,694 bales mainly of pressed cotton were received at spinning mills and 176,358 bales were exported by sea while 128,520 bales were imported by sea mainly from Karachi and Bombay. (*From the Director of Agriculture.*)

College News & Notes.

Students' Corner—Students' Club—Debate. "That in the opinion of the house India should give unconditional support to Britain in the present international crisis" was the subject of a debate held on 26-10-39 in the Free-man Hall under the Chairmanship of Miss I. H. Lowe, M. Sc. (Lond) Inspectress of Schools, Coimbatore. Mr. R. C. Broadfoot was the observer.

Games:-Inter-Collegiate Cricket. On 21-10-39 The Agricultural College played the local Govt. College on home grounds. Batting first the home team amassed a huge total of 339 (S. V. Srinivasan 170, Narayana Kamath 33, Shanker Rao 37, K. S. Ramaswami 23, and B. S. Krishnan 24. Natesan 4 for 78). S. V. Srinivasan's score of 170, included 17 fours. It was a delightful innings, where the batsman gave an all round display. This total is the highest of his career and incidentally this is the highest individual score gathered by any batsman on our grounds. The Govt. College were all out for 72, Sankaranarayanan alone making 29. S. V. Srinivasan captured 7 wickets for 36 runs. The Govt. college followed on and

compiled a total of 183 in their second venture and thus lost the match by an innings and 84 runs, (Srikant 50, Sankaranarayana 45, Palaniyappan 25, S. V. Srinivasan 4 for 40 and Ramaswami 4 for 60)

The Agricultural College students' team played the Theosophical college, Madanapalli on the 28th and 29th of October at Madanapalli Entering first the Agricultural College scored a total of 98 runs. (Narayana Kamath making 30, S. V. Srinivasan 16 and Vijayaraghavan 13 not out (Raghupathi 4 for 16 and Gopalu 3 for 33.) Batting next, the Theosophical college reached a poor total of 27. S. V. Srinivasan was chiefly responsible for skittling the rival team, bagging 6 wickets for 11 runs Of the remaining wickets, Somanna secured 3 for 15 runs. In the second innings, the Agricultural college gathered 118 runs for 7 wickets before declaring their innings, closed, S. V. Srinivasan 37, Mohiuddin 37.) The Theosophical college were all out for 67 in their second innings S. V. Srinivasan again securing the bowling honours by capturing 7 wickets for 34 runs, while Somanna took 2 for 7. By defeating the Madanapalli college, the Agricultural college has qualified to meet the Madura American college in the Semifinals of the inter-zone contest.

In the inter divisonal contest, the Agricultural college met the American College, Madura, in the Semifinal round on the 18th and 20th of October on home grounds. The ball beating the bat was a feature of the match. Winning the toss the Agricultural college elected to bat. The home team collapsed for a very meagre total of 62 runs. The skipper, K M. Somanna in scoring 33 (not out) played a captain innings, and rose up to the occasion to save his side from a miserable collapse. The bowling and fielding of the visiting team was of a very high order and the team is to be congratulated on its good performance. Mumandi captured 4 wickets for 7 runs and Vijayan 2 for 11. The American college entering next fared worse and were all out for 53, (S. V. Srinivasan 5 for 28, K. M. Somanna 4 for 19).

With a lead of 9 runs the home team entered on their second innings and were all dismissed for 71. (S. V. Srinivasan 31, K. M. Somanna 25, Chandra Babu 3 for 20, Devanasan 2 for 15 Vijayan 2 for 21) Requiring 81 runs for a win the visitors, began their 2nd innings. The atmosphere was tense with excitement as the Agricultural college team took the field. The first wicket fell for 3, the 2nd for 8, and 3rd for 17 and 4th for 20. Great enthusiasm continued during the play and the visitors were dismissed for a paltry 47 and the Agricultural college thus won the match by 33 runs, which has qualified them to the finals to be played at Madras. K. M. Somanna deserves to be specially congratulated for scoring 58 out of a total of 133 scored by his side and for capturing 9 wickets in the match.

Local Cricket Matches. A combined team of the Agricultural College and Government Arts College played the Kerala cricket club at the Agricultural College grounds in a friendly fixture on 11-11-39. The home team put up a total of 92 (N. Kamath 2), Ramanathan 19, Raghavan 6 for 33 and Narayanan 4 for 32,) The visitors scored 97 runs for 7 wickets and won the match by 3 wickets and 5 runs. K. Narayanan 34, P. M. Raghavan 26. Padmanabhan 2 for 30 Sundaran 2 for 19.)

On 12-11-39 the Agricultural College team assisted by two officers of the college played the Kerala cricket club on home grounds Entering first the home team collected 217 for 8, and declared (Mohiuddin 24, C. N. Babu 52, Kodandaraman 40, K. M. Somanna 60, Raghavan 2 for 39). The K.C. Club entering next were out for 54, Kodandaraman running through the side in a deadly spell capturing 7 wickets for 14 runs,

Hockey—In the Coimbatore Athletic Association Hockey Tournament, college met Stanes High School in the first round on 19-10-39 and lost by one goal, which was shot during the extra time.

On 8-11-39 our team played the inter collegiate hockey match against St. Josephs' College, Bangalore on Stanes' grounds. Keshava Reddy scored the first goal and this lead was kept up till the last minutes when the St. Josephs' centre forward netted the ball and the match ended in a draw for the day. Replaying the match on the next day our college sustained a defeat by 2 goals to nil, despite the spirited defence of Ayyappa in the back line against the repeated onslaught of St. Josephs' forwards.

Officers' Club Day Tournament Results. The following are the results of the tournaments conducted by the Agricultural College officers' club during the Annual Club day held on 21-10-39.

Item.	Winners.	Runners up.
1. Tennis (Singles) (C. Ramaswami's Cup)	C. N. Babu.	N. Muthuswami.
2. Tennis (Doubles) (Rao Bahadur G. N. Rangaswami Ayyangar's Cup)	M. K. Krishnaswami & K. M. Thomas.	K Sanjiva Shetty & R. L. N. Ayyangar.
3. Contract Bridge (open) Padmanabha Shield & N. L. Dutt's Cup)	G. K. Chidambaram R. K. Ayyangar.	K. S. Subba Rao & Gopala Ayyar.
4. Contract Bridge (Partners by lots) (K. Ramiah's Cup)	K. S. Subba Rao & G. L. N. Rao.	C. Rajasekahara Mudaliar & D. V. Reddy.
5. Table Tennis (M. C. Cherian's Cup)	N. Muthuswami.	D. V. Reddy.
6. Carrom (Single) (K. Krishnamurthy Rao's Cup)	C. H. Krishnan.	R. Kodandaraman.
7. Carrom (Doubles) (Shiva Rao's Cup)	C. H. Krishnan & D. V. Reddy.	P. K. Menon & Kodandaraman.
8. Chess (Vellodi's Cup)	E. J. Varghese.	T. K. Mukundan.

Inter-Collegiate Sports, Madras University. The athletic sports for the Bangallore Division comprising of Ceded Districts colleges, Anantapur; St. Joseph's College, Bangalore; Theosophical College, Madanapalle; Voorhees' College. Vellore; Islamia College, Vaniambadi; Municipal College, Salem, Government Arts College, Coimbatore and the Agricultural College, Coimbatore were held in the Agricultural College maidan on the 6th and 7th November 39. Out of the eight colleges only St. Joseph's college Bangalore, Voorhees' College, Vellore and two local colleges competed. The events were keenly contested. The St. Joseph's College Bangalore won the first place in hop, step and jump 400 metres dash, pole vault, 200 metres race, long jump, shot put, 1500 metres, and 100 metres race while the Agricultural College won the 1st place in 200 metres hurdles 110 metres hurdles, and high jump. The championship was, won by the St. Joseph's College scoring 51 points as against 34 points obtained by the Agricultural College.

Foot and Mouth Disease. A vigorous campaign against foot and mouth disease is carried on by the central farm, Coimbatore, owing to the prevalence of this foul disease of cattle in the vicinity of the estate. As a result of restricted wheeled traffic and vigorous disinfectant measures taken, the animals in the Central Farm are so far free from the disease.

Visitors. Dr. J. A. Mulyil, B. A., Ph. D., Biological Control officer of the Imperial Institute of Agriculture. New-Delhi camped here from 13th to 20th instant. He addressed the students of the Agricultural College on "Biological control of Insect pests" on 17-11-39 at the Freeman hall.

A party of 20 students from the District Board Industrial and Agricultural School, Sivaganga, led by their Headmaster Sri. D. T. Danapandian, B. A., B. Sc. Ag., L. T., an alumnus of our College stayed in the Estate from 14-11-39 to 17-11-39 for getting themselves acquainted with the work done by the Agricultural Department.

Monsieur Koesnoto, Agricultural expert, Department of economic affairs Batavia arrived in Coimbatore on the 19th Nov. and stayed till the 22nd during which period he visited the millets, cotton and Imperial sugarcane stations and the oil seeds laboratory in order to acquaint himself with the work on these crops. He also visited the Research Institute and Central Farm during his stay and proceeded to Madras *en route* to Calcutta.

Season. An unusual rainfall of 12·18" was received (as recorded at the research Institute) during October. For the last 33 years, this record has been surpassed only once during 1930, when during October, the rain-fall was 16·03". While these showers were welcome after 4 years of droughty conditions, a better distribution of the rains would have been more helpful. Cambodia cotton sown early in September has not been much affected, but later sown dry cottons were caught too early by the rains. Rain-fed cholam which was coming into ears has been rather adversely affected. The monsoon has not still abated, as during the 15th, 16th and 17th of November, there was unceasing rainfall amounting to 3·5 inches. Further rains under present conditions will not be helpful for some time.

An Announcement—Ramaya Shetty Memorial fund. A sum of Rs. 83 collected by well wishers of the late M. Ramaya Shetty (Farm Manager, Cotton Station, Coimbatore) has been offered to the Madras Agricultural Students' Union by the trustees of the fund. This amount will be utilised for the institution of a rolling silver cup to be awarded during the Annual College Day Sports for 220 yards dash.

Entomological Society of India. Meetings of the South Indian branch of the above association were held in Coimbatore on the 13th and 14th of October and also on the 8th of November. The local members were present and Sri M. C. Cherian presided. The following interesting papers were read and discussed:—

1. The need for intensive systematic studies on Indian insects by Dr. T. V. R, Ayyar.

2. Snails as pests of paddy by M. C. Cherian.

3. *Spathius vuliificus* as a possible parasite for the control of the cotton stem weevil by P. N. Krishna Ayyar and P. S. Narayanaswami.

4. *Tetrastichus ayyari*, Rohwr., a pupal parasite of sugarcane and cholam borers' by M. C. Cherian and C. K. Subramaniam.

5. *Geomermis indica* St. a new nematode parasite of the Cotton stem weevil' by P. N. Krishna Ayyar.

6. Anophelene mosquitoes of Coimbatore and its surroundings by T. V. Subramaniam.

A large number of interesting specimens of insects were also exhibited.

Weather Review—OCTOBER 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	8·1	+0·4	30·7
	Calingapatam	10·0	+2·0	28·2
	Vizagapatam	14·6	+7·5	29·1
	Anakapalli*	13·6	+6·0	35·7
	Samalkota*			
	Maruteru*	24·4	+17·2	41·9
	Cocanada	29·5	+21·6	52·0
	Masulipatam	24·4	+16·3	41·4
	Guntur*	17·5	+11·9	33·3
Ceded Dists.	Kurnool	3·3	−0·2	16·5
	Nandyal*	0·0	0·0	0·0
	Hagari*	7·6	+4·3	20·9
	Siruguppa*	4·6	+0·5	21·2
	Bellary	6·7	+2·8	16·9
	Anantapur	4·6	+0·9	23·6
	Rentachintala	10·7		25·2
	Cuddapah	4·6	−0·4	22·8
	Anantharaju-pet*	8·0	+3·4	21·5
Carnatic	Nellore	15·1	+6·7	24·7
	Madras	5·1	−6·6	19·8
	Palur*	10·0	−0·4	33·1
	Tindivanam*	10·3	+1·4	27·9
	Cuddalore	16·3	+5·3	45·5
Central	Vellore	9·1	+2·8	29·2
	Salem	10·9	+4·2	43·6
	Coimbatore	11·8	+5·4	20·9
	Coimbatore A. C. & R. I.*	12·2	+6·5	21·9
	Trichinopoly	12·8	+5·9	33·1

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	8·6	−1·9	30·1
	Aduthurai*	13·9	+5·3	37·5
	Madura	6·3	−1·5	30·4
	Pamban	1·4	−7·6	10·3
	Koilpatti*	0·0	0·0	0·0
	Palamkottah	3·1	−3·7	9·8
West Coast	Trivandrum	7·7	−2·9	53·1
	Cochin	16·8	+3·6	123·7
	Calicut	11·8	+1·6	109·1
	Pattambi*	8·4	−3·8	88·7
	Taliparamba*	0·0	0·0	0·0
	Kasargode*	5·8	−3·4	115·8
	Nileshwar*	11·0	+1·7	115·6
	Mangalore	7·9	+0·4	112·4
Mysore and Coorg	Chitaldrug	4·6	+0·3	28·2
	Bangalore	7·5	+1·6	32·4
	Mysore	10·4	+3·9	27·5
	Mercara	11·8	+3·1	99·1
Hills	Kodaikanal	11·1	+1·4	44·5
	Coonoor			
	Ootacamund*	13·2	+8·5	47·2
	Nanjanad*	9·6	+2·3	42·9

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1937 published in the Fort St. George Gazette.

Weather was generally fine over the Madras Presidency for the first ten days of the month with scattered thundershowers but the seasonal change in the distribution of pressure over the Bay of Bengal had begun to set in, and determined the influx of sea winds into the peninsula. About the 15th conditions became unsettled in the Central region of the Bay but failed to develop further, and by the 17th conditions became unsettled in the South East Arabian sea off the Malabar Kanara Coast; and developing into a depression moved out in a North West direction and became unimportant by the 21st. On the 20th conditions became unsettled in the Bay off the Coromandal-Circar Coast which by the 21st developed into a depression, passed inland on the 22nd and lay over North Deccan till the 25th when it became unimportant. Conditions again became unsettled off the Coromandal-Circars coast on the 29th, which developed into a depression and crossed the coast near Cocanada by the 31st. The Arabian sea depression and the two Bay depressions gave rise to widespread and locally heavy rains from the middle of the month. Rainfall was particularly heavy on the Coastal

area between Nellore to Cocanada during the passage of the two Bay depressions, and occasioned much damage to crops and property in that area.

Rainfall was in very large excess on the south Circars coast, in the central districts, parts of the Deccan, Mysore and Coorg and the hills, locally in the Carnatic and normal or in slight defect elsewhere.

Chief reports of rainfall:—

Cocanada.	..	6·7"	on 22nd.
Masulipatam.	...	4·9"	on 21st.
Maruteru.	...	7·9"	

Special reports of heavy rainfall:—

Narasapur.	...	10·4"	30th.
Bhimavaram.	...	10·3"	30th.
Tanuku.	...	6 6"	30th.
Ellore.	...	5·7"	30th.
Nellore.	...	5·5"	29th.

Weather Report for Research Institue Observatory.

Report No. 10/39.

Absolute maximum in shade.	...	91·0°F.
Absolute minimum in shade.	...	64·0°F.
Mean maximum in shade.	...	87·7°F.
Departure from normal.	...	+0·2
Mean minimum in shade.	...	70·7°F.
Departure from normal.	...	+0·3
Total rainfall for the month.	...	12·18"
Departure from normal.	...	+6·5
Heaviest fall in 24 hours.	...	2·53 on 31st.
Number of rainy days.	...	12
Mean daily wind velocity.	...	1·6 m. p. h.
Departure from normal.	...	−1·2 m. p. h.
Mean humidity at 8 hours	...	82·8 %
Departure from normal.	...	+2·9 %

Summary. The rainfall of the month was 12·18" which was more than 100 % in excess of the normal, this being the first occasion since 1930 when so large a fall has been recorded. The rain was associated with the disturbances in the Arabian Sea and Bay of Bengal. The heaviest fall in 24 hours was on the 31st when 2·54" was recorded. Skies were in general heavily clouded and temperatures in slight excess. Mean humidity at 8 a. m. was in slight excess and wind velocity below normal. P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notifications.

Appointments.

Sri S. Ramachandra Ayyar, Assistant, Entomology Section, is appointed to Category 7 of Class I, Madras Agricultural Service, and to officiate as Assistant Entomologist with effect from the date of taking charge *vice* Sri. P. N. Krishna Ayyar on other duty.

Sri. P. N. Krishna Ayyar, Assistant in Entomology, I grade, and officiating Assistant Entomologist, Coimbatore, in category 7, Class I, Madras Agricultural Service, is appointed to be temporary Parasitologist, Coimbatore, in the same category, with effect from the date of taking charge.

Transfers.

Name of Officers.	From	To
Sri. K. Unnikrishna Menon,	Dy. D. A. (on leave)	Dy. D. A., Coimbatore.
„ C. Ramaswami Nayudu,	Offg. Dy. D. A., Coimbatore.	J. L. A. & Asst. Supdt., Central Farm, Coimbatore.
„ M. Kanti Raj Nayudu,	Offg. J. L. A. & Asst. Supdt. Central Farm Coimbatore.	Offg. as gazetted Asst. to the Principal, Coimbatore.
„ R. N. K. Sundaram,	Dy D. A., III circle, Trichinopoly.	Asst.. D. A., Bellary.
„ A. Ramaswami Ayyar,	Offg. Supdt., A. R. S., Anakapalli.	Offg. Asst., D. A., St., Thomas Mount, Madras.
„ R. Swami Rao,	Asst., D. A., St. Thomas Mount, Madras.	Asst. D. A., Guntur.
A. Gopalakrishnaiyah Naidu,	Affg. Asst., B.A., Guntur.	Offg. Asst., B.A., Nellore.

Leave.

Name of Officers.	Period of Leave.
Sri. M. U. Vellodi, Asst. D. A., Tellicherry,	L. a. p. for one month and 21 days from 1—11—39.

Subordinate Services.

Appointment.

Sri. A, Mariakulandai, officiating Assistant in Chemistry Section, is appointed as Temporary Assistant in Chemistry in the Animal Nutrition Scheme financed by the Imperial Council of Agricultural Research, with effect from 1st November 1939 in the post liberated by Sri. Y. V. Narayana Ayya.

Transfers.

Name of officers	From	To
Sri S. Veeravarada Raju	A. D., Trivellore (on leave)	A. D., Madanapalle.
„ M. Subramanya Chetty	Asst. in Cotton A. R. S., Guntur	1st circle,
„ P, Parthasarathy		A. D., Puttur under training
„ P. S. Narayanaswami	Asst. in Entomology, Coimbatore	Special duty at Payyanur for 4 months.
„ N. Krishna Menon	Asst. in Entomology, Coimbatore	Special duty at Vadavanur, Palghat.
„ V. N. Subbana Acharya	Offg. Asst. D. A., Bellary	A. D., II circle.
„ R. Govindan Nambiar	F.M., A,R.S., Taliparamba	A.D., Cheyyar.
„ K. Gurumurthi	A.D., Chellapalli	Tobacco market yard Supdt., Bezwada.
„ P. Sudarsanam Naidu	A. D. Masulipatam	Tobacco market yard Supdt , Mangalagiri,
„ Y. Venkateswar Rao Naidu	A. D., Bapatla	Tobacco market yard Supdt., Ongole.

„ K. V. Gourangamurthy	A. R. S., Maruteru	A. D., Nandigama
„ N. V. Narasimha Sastri	A. D., Guntur (on leave)	A. R. S., Anakapalli.
„ R. Subbiah Pillai	A. R. S., Palur	A. D., Ambasamudram.
„ S. Ponnuswami Naidu	A. D., Ambasamudram	A. D., Atmakur.
„ N. Subramanya Ayyar	A. D., Kulitalai	F. R. S., Kodur.
„ L. Narasimhacharya	Offg. Asst., A. D., Nellore	A. D., Chittor.

Leave.

Name of officers.	Period of leave.
Sri L Krishnan, A. D., Tanjore	L. a. p. on m. c, for 1 month from 5—11—39.
„ M. S. Purnalingam Pillai, Asst. in Cotton Section, Coimbatore	L. a. p. for 1 month and 6 days from 16—11—39.
„ P. Lakshminarayana, Asst. A. D., Cocanada	Extension of l. a. p. for 4 months from 4--11—39.
„ S. Venkatarama Ayyar, A. D., Sriperumbudur	L. a. p. for 2½ months from 3--1—1930.
„ K. S. Krishnamurthy Ayyar, A. D., Trichinopoly	Extension of l. a. p. for 1 month and 14 days from 8—11—39.
„ G. Ganapathy Ayyar, Asst. in Chemistry, Coimbatore	Extension of l. a. p. for 1 month from 2—11—39.
„ P. S. Krishnamurthy Ayyar, Entomology Asst., Bellary	L. a. p. for 1 month and 29 days from 23-10-39.
„ V. K. Kunhunni Nambiar, F. M., A. R. S., Pattambi	L. a. p for 2 months from 22-10-39.
„ U. L. Srinivasa Rao, A. D., Kollegal	L. a. p for 1 month from 20-10-39.
„ C. Annamalai, A. D., Madanapalli	L. a. p. for 1 month from 6—11—39.
„ Uchil Ananda, F.M., A.R.S., Pilicode	L. a. p. for 29 days from 23—11—39.
„ R. Subbiah Fillai, A. R. S., Palur	A. D., Ambasamudram.

The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

Vol. XXVII.] DECEMBER 1939 [No. 12.

EDITORIAL

Agricultural Research and the War. In our last issue we made a plea that the war should not in any way hamper the activities of agricultural research organisations in this country. We urged that rather than curtailing research activities, they should be strengthened in such a manner as to augment the economic prosperity of the country and the Empire. It is heartening to agricultural research workers in this country and to the millions who stand to benefit by their activities that two of India's foremost administrators who are best qualified to speak on the subject, have expressed themselves convincingly on the importance of agricultural research in wartime. Addressing the advisory board of the Imperial Council of Agricultural Research, Mr. P. M. Khareghat, Vice Chairman and chief administrative officer of the council has expressed the view that "research designed to develop agricultural and live stock resources of the country must continue." Sir Jagadish Prasad, member of the Viceroy's Executive Council and member in charge of Education, Health and Lands, addressing the crop and soil wing of the Board of agriculture and animal husbandry, went a step further when he laid bare a fallacious belief held in certain quarters that in times of emergency research is the first item which comes up for retrenchment. Sir Jagadish deplored this attitude and quoted the example of Great Britain where the Department of Scientific and Industrial Research came into being in 1917 at a critical period during the Great war when a sum of £ 1,000,000 was made available to this purely research organisation. Later events amply justified the wisdom of this investment at a period of crisis and competent critics have expressed the view that no expenditure was laid to better use than the money spent on pure research. He declared that it is up to those who are responsible for guiding and fostering agricultural research in India to take advantage of the increased demand on commodities of which India is the prime producer "by using the opportunity for new drives towards greater efficiency in crop production, interpreting old knowledge in the light of the new crisis, and adding as quickly as may be, new knowledge to meet old difficulties." It is a matter of satisfaction to us that representatives of the Imperial Council of Agricultural Research and the Government of India share the view that instead of being an obstacle to progress, the war situation may, if rightly used, be an opportunity to accelerate scientific progress in India, a need which all well wishers of the country rightly realise.

A Preliminary Study in the Biometric Variations in the Indian Honey Bee.

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Introduction. The existence of variations in plant or animal life is the factor that facilitates the work of the biologists towards the isolation of the more useful varieties for purposes of further improvement. Newton (1917), Ghosh (1936) and Ramachandran (1937) have recorded about the larger honey storing capacities, their darker colour and larger size of some hill varieties of Indian bees. Even in the varieties found in the plains, the present author has observed certain colonies showing remarkably desirable characters, such as mild temper, minimum swarming propensities, larger honey gathering and stamina to resist unfavourable seasonal conditions. Ramachandran (1937) has also made mention of the different "idiosyncracies" of the various hives in an apiary. A detailed study of the biometric variations, if any, that differentiate bees possessing diverse characters has not so far been made in India.

Review of Literature. Merrill (1922) working in America found that there is a distinct correlation between tongue length of bees and their carrying capacity, that the colonies having bees with longer tongues contain heavier bees and are more populous in spring, and that if a bee is deficient either in tongue length or in weight or in carrying capacity, the disadvantage may be overcome if it possesses the two other of the above three characters to a greater degree. Alpatov (1929) has worked on the biometry of the most important European races of the honey bee based on materials collected in their respective native locations in Europe as well as materials collected in the U. S. A., where the honey bee was imported from Europe. He has classified the influence of different environmental conditions on the honey bee and has concluded that such factors as season, temperature, size of cells, age of combs, nutrition of larva, strength of colony etc.,—all these —affect the biometry of the honey bee. He has also studied in detail the geographical variations in the biometry of the honey bee and finds that the southern constitutional type of the European bee differs from the northern one. This worker further concludes that "parallel to the geographical variation in physical characteristics run the variation of biology and behaviour" such as swarming propensities, preference in collecting nectar from different plants etc. Phillips (1929) has studied the correlations between the various appendages of the honey bee and has concluded that the drones show greater variations then workers and that the size of the comb cell shows great heterogenity and this affects the size of the adult bees. Kellog and Asquith (1934) studied the variations in individual colonies with a view to isolating the more useful ones. They

found certain variations in the capacity of nectar sac and the pollen loads brought by bees but much less variations in biometric measurements. Grout (1937) provided artificial comb foundations with varying cell dimensions and concluded that the size of the brood cell is definitely a factor in determining the size of the adult worker bee. He adds (Grout, 1936) that no increased quantity of honey is proved to have been obtained by the employment of enlarged cell foundations. Nolan (1937) has given a resume of the various attempts made at breeding the honey bee taking advantage of the variations. In some respects the observations of McGregor (1938) are not in conformity with those of Alpatov (1929) since the former has found that nurse bees exert no abnormal influence on the development of worker bees as seen by their tongue and wing dimensions, and that the seasonal trends and honey flow also do not affect tongue and wing lengths.

Material and Methods. The present investigation was undertaken to study the biometric variations in the Indian honey bee, collecting material, if possible, from a number of localities, but owing to personal reasons, the author finds it inconvenient to complete fully the scope of the work, and in the present paper, the data so far collected are presented.

The data relate to four colonies of *Apis indica*, which showed some variations particularly in the strength of each colony during a period of a little over three years. Colony Nos. I and IV possessed no supers during all these years, while colony No. II had one super and colony No. III two supers. It was also noticed that colony Nos II and IV gave almost equal quantities of honey (a three year average of 9·9 lb. and 10·2 lb. per annum for colony Nos. II and III respectively) despite the fact that the former has only one super as against two supers possessed by colony No. III.

Alpatov (1929) has concluded that the biometry of the honey bee is affected by a number of environmental factors such as temperature, season etc., and Wedmore (1932) has indicated that even the age of the field bees depends to a very large extent on the amount of work they turn out, and their weight depends on their age. The effect of all these variables has to be reduced to a minimum so as to provide almost identical environmental conditions before comparing the biometry of the bees. And for this purpose, bees were collected from the four hives within a period of six consecutive days.

For his studies in Russia, Alpatov (1929) has used about 100 bees from each colony, and a minimum of five colonies for each locality. But in U. S. A. he has taken only five bees from each of ten colonies at each locality for the reason that there is no definite racial variation in U. S. A. where queens only are introduced. It was originally the present author's intention to collect at random 100 bees from each of the four colonies—50 being nectar gatherers and 50 being pollen collectors. But it has only been possible to report on about 50 nectar gatherers taken from each hive.

Bees returning to the hive without any load on their pollen baskets were caught in separate specimen tubes and they were killed immediately in

cyanide bottles used usually in entomological investigations. To find out whether each bee has a load of nectar or water, the bees were placed on a filter paper and their abdomens gently pressed. The contents of the honey sac that is disgorged on the filter paper was allowed to dry for a few seconds. Nectar leaves a translucent spot on the filter paper, but no such spot is left in the case of water. This method of distinguishing nectar-carriers from water-carriers was reported previously by Park (1926). Only nectar gatherers have been used for the following biometric studies, eliminating water carriers.

Measurements of tongue, right forewing, and right hind leg together with the number of hooks on the second right wing were recorded. Wings and legs of the bees were immediately removed and kept mounted on slides. The heads of the bees were macerated in a 5 per cent. solution of potassium hydroxide as described by Alpatov (1929). The tongues were then dissected and kept mounted in glycerine jelly.

Diameter of comb cells.— During the course of study it was casually observed that even the cell measurements in the brood combs of the Indian bee appear to vary. Seven brood combs from one hive (Newton's pattern) were at one time available and leaving aside the few rows of cells at the top which are usually used for storing honey, measurements of the diameter of the worker brood cells that were recorded are furnished in Table I.

TABLE I. Diameter of cells in brood combs.

Unit of measurement.	Diameter per cell.	No. of cells.	Percentage of total.
	mm.		
8 cells in 31 mm	3 7/8	352	2·0
7 ,, 27 mm.	3 6/7	308	1·7
6 ,, 24 mm.	4	4,410	25·0
8 ,, 33 mm.	4 1/8	2,136	12·1
7 ,, 29 mm.	4 1/7	2,156	12·2
6 ,, 25 mm.	4 1/6	2,700	15·3
5 ,, 21 mm.	4 1/5	1,770	10·0
4 ,, 17 mm.	4 1/4	176	1·0
7 ,, 30 mm.	4 2/7	2,163	12·3
3 ,, 13 mm.	4 1/3	897	5·0
8 ,, 35 mm.	4 3/8	360	2·0
5 ,, 22 mm.	4 2/5	225	1·3
		17,653	100·0

It is observed that the frequency distribution of the diameter of the comb cells is multimodal. Phillips (1929) and Grout (1937) have stated that this variation in the size of comb cells would affect the development of bees.

Tongue.— The tongue was measured in three parts, viz., submentum, mentum and ligula. For considerations of space, frequency distribution of the lengths of each of these parts has not been furnished. However, in Table II the mean lengths of these parts in the case of the hives under study are presented.

TABLE II. Length of tongue parts (in millimeters)

Hive Nos.	Submentum.	Mentum.	Total of submentum and mentum.	Ligula.
I	0·293	1·248	1·541	2·891
II	0·295	1·265	1·560	2·900
III	0·278	1·278	1·556	2·821
IV	0·269	1·290	1·559	2·753
Mean of all hives.	0·284	1·270	1·554	2·841

Table II indicates that the longest submentum occurs in hive Nos. I and II, and the shortest in hive IV; but the longest mentum is only in hive IV. It therefore appears reasonable to conclude that the bees from those hives having short mentum have relatively long submentum and *vice versa*. Nevertheless, the total aggregate length of the submentum and mentum display less variations and it is observed that no significant differences in the means of hives II, III and IV exist. As for ligula, hive IV has the shortest while hive II has the longest.

In Table III the frequency distribution of the total length of the proboscis is given. These frequencies show multimodal trends. Hive II appears to possess the longest tongue (about 4·5 mm.) and hive IV the shortest (about 4·3 mm.) the mean of all the hives being about 4·4 mm. The frequency trends being multimodal, the general means are not compared.

TABLE III. Total length of proboscis (in millimeters).

Hive No.	3·50 to 3·59	3·60 to 3·69	3·70 to 3·79	3·80 to 3·89	3·90 to 3·99	4·00 to 4·09	4·10 to 4·19	4·20 to 4·29	4·30 to 4·39	4·40 to 4·49	4·50 to 4·59	4·60 to 4·69	4·70 to 4·79	4·80 to 4·89	4·90 to 4·99	5·00 to 5·09	Total.	Mean.
I	...	1	1	1	1	4	5	2	2	5	11	12	1	1	2	1	50	4·435
II	...	...	1	...	6	2	1	1	4	7	4	12	9	2	...	...	49	4·463
III	1	1	2	3	2	...	1	2	9	5	10	10	4	...	..	...	50	4·379
IV	...	1	4	4	2	2	2	5	7	3	8	7	4	...	...	...	49	4·308
Total	1	3	8	8	11	8	9	10	22	20	33	41	18	3	2	1	198	4·397

Right Forewing. In Tables IV and V the length and breadth respectively of the right forewing have been furnished. There was a small accident and some of the slides were destroyed particularly of those from hive III. The length of the wing was measured in two stages, viz, proximal length and distal length, as described by Nolan (1937). The proximal length and distal length are almost equal being about 3·7 mm. From tables IV and V it will be seen that the length of wing of the Indian bee is about 7·4 mm. while its breadth is about 2·6 mm. and no significant differences in the means have been observed. According to Kellog and Asquith (1934) the average wing length of the European bee is about 9·3 mm. while the breadth is about 3·3 mm.

TABLE IV. Length of forewing (in millimeters).

Hive No.	6·91 to 7·00	7·01 to 7·10	7·11 to 7·20	7·21 to 7·30	7·31 to 7·40	7·41 to 7·50	7·51 to 7·60	7·61 to 7·70	7·71 to 7·80	Total.	Mean.	S. D.	S. E.	C. V.
I	...	...	4	6	12	10	6	2	3	43	7.415	0·1536	0·0234	2·1
II	...	1	4	11	8	9	7	3	2	45	7·395	0·1594	0·0238	2·2
III	1	2	1	8	6	7	7	2	...	34	7·376	0·1622	0·0278	2·2
IV	...	2	3	9	17	8	5	...	1	45	7·357	0·1301	0·0194	1·8
Total	1	5	12	34	43	34	25	7	6	167	7·386	0·1518	0·0117	2·0

Conclusions :—I, II, III, IV.

TABLE V. Breadth of forewing (in millimeters).

Hive No.	2·41 to 2·45	2·46 to 2·50	2·51 to 2·55	2·56 to 2·60	2·61 to 2·65	2·66 to 2·70	2·71 to 2·75	2·76 to 2·80	Total.	Mean.	S. D.	S. E.	C. V.
I	1	3	4	11	9	9	5	1	43	2·618	0·0753	0·0115	2·9
II	...	1	3	12	14	9	6	...	45	2·630	0·0580	0·0086	2·2
III	...	...	1	8	10	7	8	...	34	2·649	0·0557	0·0096	2·1
IV	...	...	1	10	14	11	8	1	45	2·678	0·0547	0·0082	2·0
Total	1	4	9	41	47	36	27	2	167	2·639	0·0629	0·0049	2·4

Conclusions :—IV, III, II, I.

Nolan (1937) has referred to the ratio between the length of veins marked by him as *e* and *f* in the third cubital cell of the right forewing, and states that this index is a hereditary factor wherein low cubital index is completely dominant over the high index. In Table VI this index in respect of the colonies under study is furnished. It will be seen that hive III has a very high index while hive II has the lowest. Although hives I and IV have equal indices the latter exhibits a coefficent of variation of 17·8 percent as against 12·8 per cent for hive I.

TABLE VI. Third cubital index of right forewing (Ratios).

Hive No.	0·21 to 0·22	0·23 to 0·24	0·25 to 0·26	0·27 to 0·28	0·29 to 0·30	0·31 to 0·32	0·33 to 0·34	0·35 to 0·36	0·37 to 0·38	0·39 to 0·40	0·41 to 0·42	Total.	Mean.	S. D.	S. E.	C. V.
I	...	3	2	4	9	9	7	2	5	2	...	43	0·31	0·0395	0·0060	12·75
II	2	3	5	10	15	8	1	1	...	...	...	45	0·28	0·0279	0·0042	9·96
III	...	...	1	...	2	8	10	3	5	3	2	34	0·34	0·0342	0·0059	10·05
IV	...	4	10	2	9	5	3	2	2	2	6	45	0·31	0·0551	0·0082	17·76
Total	2	10	18	16	35	30	21	8	12	7	8	167	0·31	0·0454	0·0035	14·64

Conclusions :—III, I, IV, II.

No. of Hooks on the Second Wing. In Table VII the number of hooks found on the second wing of the bees is indicated. All except colony III have an average of about 17 hooks while colony III alone has 18. This difference is statistically significant.

TABLE VII. Number of Hooks on the Second Wing.

Hive No.	14	15	16	17	18	19	20	21	Total	Mean	S. D.	S. E.	C. V.
I	...	2	9	6	14	2	3	...	36	17·4	1·242	0·207	7·14
II	...	1	11	12	8	5	...	1	38	17·2	1 872	0·223	7·98
III	...	...	1	7	9	8	3	...	28	18·2	0·993	0·188	5·46
IV	1	2	7	15	15	2	2	...	44	17·3	1·060	0·160	6·13
Total	1	5	28	40	46	17	8	1	146	17·5	1·198	0·099	6·84

Conclusions :— III, I, IV, II.

Hind Leg. Separate measurements of femur, tibia and metatarsus were determined but they are not furnished in this paper. But in Table VIII the mean measurements of these parts for each hive is separately given.

TABLE VIII. Measurements of leg parts (in millimeters)

Hive Nos.	Femur.	Tibia.	Metatarsus.	Breadth of Metatarsus.
I	2·09	2 43	1·57	0·94
II	2·09	2·44	1·58	0 94
III	2·08	2·52	1·63	0·97
IV	2·10	2·41	1·55	0·94
Total	2·09	2·45	1·58	0·94

Table VIII indicates that though the length of femur of the bees in hive III is slightly less than that in hives I and II, yet the bees of hive III have relatively longer tibia and metatarsus, and as a result they possess very long legs, and also broad metatarsus. Table IX will show that hives I and II possess bees of equal leg lengths while hive IV has very short legged bees.

TABLE IX. Length of hind leg in millimeters.

Hive No.	5·71 to 5·80	5·81 to 5·90	5·91 to 6·00	6·01 to 6·10	6·11 to 6·20	6·21 to 6·30	6·31 to 6·40	6·41 to 6·50	Total.	Mean.	S. D.	S. E.	C. V.
I	2	3	9	13	10	4	3	1	45	6·08	0·1588	0·0237	2·61
II	...	6	6	10	5	13	3	...	43	6 11	0·1475	0·0225	2·41
III	...	...	4	2	8	16	8	3	41	6·21	0·1356	0·0212	2·18
IV	...	1	11	16	14	6	1	...	49	6·04	0·1009	0·0144	1·67
Total	2	10	30	41	37	39	15	4	178	6·12	0·1397	0·0105	2·28

Conclusions :—III, II, I, IV.

Discussion. The present study was undertaken primarily with a view to find out whether differences in biometry are met with in Indian bees. It has been noticed that wing measurements are almost equal in all the hives.

Hive II, the one super colony, has bees with long tongues, low cubital index, fewer hooks on the second wing, and hind leg of medium length. Hive III which is a very strong colony with two supers has bees with short tongue, high cubital index, larger number of hooks, on the second wing and very long legs. It should be remembered that both hives are almost equal in honey gathering capacities, despite the larger population of bees in hive III.

At best the present study is only of a very preliminary nature and further work on a number of hives of known behaviour would be very necessary before any definite attempt is made at correlating behaviour of bees and their biometry.

Selection and hybridization are the two important lines of work connected with the improvement of any species, and before any attempt at improving the Indian honey bee is taken on hand, a fuller knowledge of the variations that exist in the biometry and behaviour of different colonies of bees, and the correlations if any that exist between them is urgently called for. The consciousness of our farmers to the possibilities of bee-keeping as a cottage industry is now developing very fast, and many of the Provincial and State Governments in India are actively sponsoring schemes for popularising this industry. At this stage it seems very opportune indeed to consider the feasibility of carrying out a more thorough investigation into the biometric variations of bees from various colonies of known behaviour situated in diverse localities. Such a study would perhaps facilitate the compilation of a key for the ready identification of bees possessing desirable characters instead of watching their performances and behaviour over a long period of time. These colonies can be multiplied with advantage and they may form the parent stock for further breeding. Whether particular biometric characters are stable even under changing environmental conditions is also a matter to be thoroughly studied if improving the honey bee by selection is to be successful at all. Queen rearing as an aid to the improvement of honey bee by selection is well recognised in all the important honey producing countries of the west. But so far as the conditions obtaining in India at present are concerned, this method of improving the Indian honey bee seems to be of little importance unless the mating of queens with drones from undesirable colonies can, to a reasonable extent, be prevented.

Summary and Conclusions.— For the first time a study in the biometric variations of the Indian honey bee is reported in the present paper. Four colonies of *Apis indica* have been chosen for study and the tongue lengths of bees, their wing measurements, number of hooks on the second wing, and the length of the hind leg have been recorded. They exhibit some variations in biometry particularly in tongue length, index of the third cubital cell of the right forewing, number of hooks on the second wing, and leg measurements. There is practically no variation in the length and breadth of the right forewing. Some variation in the diameter of comb cells of a hive are also observed.

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A Note on Sugarcane Cultivation in the South Canara District.

BY K. TEJAPPA SHETTY, B. Sc., Ag.,

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Introduction. There is an area of about 5000 acres under the sugarcane crop in the four coastal taluks of Coondapoor, Udipi, Mangalore and Kasargod in the South Canara District This area was under one or two local varieties called "Dasa Kabbu" and Bidru "Kabbu". Red mauritius was introduced two decades ago, and now this variety has almost replaced the old local varieties.

The trial of some of the Co-varieties is in progress in the Kallianpur sugar factory area. The performances of a few of the thick cane varieties like Co. 419, 413, 421 and 408 are really good and there is already an area of about 150 acres under these Co-varieties in the two Taluks of Mangalore and Udipi. The results so far achieved go to show that these improved Co-varieties are much superior to the Red mauritius variety, both in tonnage and juice quality, and we hope that within the course of another 10 years, these Co-varieties will completely replace the Red mauritius variety which is fast deteriorating.

Sugarcane is mainly grown along the river basins, where the soils are well drained. It is regularly rotated with paddy, and heavily manured.

Preparatory cultivation. Soon after the harvest of the 1st crop paddy in October, the preparatory cultivation for sugarcane is started. The land is ploughed twice with the country plough and the levelling board is passed over. Then the land is ploughed at intervals and the bunds trimmed. With about 6 to 8 ploughings, the land is brought to fine tilth and early in December, ridges and furrows are opened with spades and human labour. The furrows will be 9"—10" deep and are opened at regular distances of a yard, the length of the furrows being short, to facilitate lift irrigation. The furrows are left for sun-drying for about a week before planting the setts. No manure is applied to the fields either during the preparatory cultivation or during planting.

Planting. December—January is the main planting season in the Kallianpur Sugar Factory area while the season extends up to February—March in other parts. Only the top setts of the canes are used for planting. During the harvest of the previous crop, healthy top setts are separated and topped with the leaf sheaths intact and bundled. These bundles are soaked in some shallow sweet water for a day and then removed and kept covered in a shady airy place, till the eyebuds begin their activity and start germination under favourable conditions of temperature. The setts can be preserved this way for about 3 weeks, because the development of the buds will be slow under cover of the leaf sheaths. The other method of curing the setts is to pit them in shallow pits and cover them over with some straw and a thin layer of earth.

When the land is ready for planting, the cured setts are taken out, stripped and cut into small setts with 3 to 4 nodes each. They are planted in the dry soil in the furrows and covered over with a thin layer of the fine soil, care being taken to plant the setts with their eye-buds on either sides. Now irrigation water is let in and a good soaking irrigation is given. The practice of trampling in the setts with irrigation, is not practicable in this sandy soil. It takes 12,000 —15,000 setts to plant an acre.

The germination in the cured setts starts on the third day and will generally be very satisfactory. On the fourth day after planting, a light irrigation is given, followed by another light irrigation on the eighth day. The field is left dry for about 10 days, when all the buds germinate and then, regular irrigations are given once a week, till the onset of the S. W. Monsoon.

Manuring. Though the crop is manured heavily in this district, the manuring starts only when the crop is about 40 days old. The first manuring is done when the crop is about six weeks old, with 10 cart loads of farm yard manure and 100 lbs. of ammonium sulphate per acre. The manure is applied in the furrows and the crop slightly earthed up with spade and manual labour. This light earthing up serves as a hoeing and weeding to

the whole field. The second manuring will be, when the crop is about two months old, with about 10 cart-loads of either farmyard manure alone or a mixture of farm yard manure and fish manure or with 5 cart-loads of farm yard manure and 100 lb. of ammonium sulphate with a good earthing up. Then there is the final manuring with about 20 cart-loads of 'burnt earth' per acre and earthing up. The burnt earth is prepared by burning the trash and stubbles of the previous sugarcane crop mixed with a good quantity of the top soil of the field with a slow fire. When the manuring is over, the crop is finally earthed up and drainage channels are dug in the fields, soon after the first trashing is given, in the first week of June with the onset of the S. W. monsoon.

Other operations. During the monsoon, trashing the canes is the only operation. Trashing is done once a month and in places where there are attacks from jackals, wrapping also is done simultaneously.

Harvesting. The harvest season extends from October to February. The early planted crops are harvested in October to take advantage of the early market. No irrigation is given to the crop even if they are left in the field till February. Harvesting is done by digging out the clumps with a 'quintany' (pickaxe) to get even the root portion of the canes for milling.

Milling. Iron mills have completely replaced the old wooden mills in the area. Mills are set up near the fields and two boilings of 18 Kerosene tins (72 gallons) of juice each, are taken every day. It requires two pairs of animals and two men per day, to take two boilings. The crushing percentage and the recovery are satisfactory, being about 65% and 10% respectively. Most of the sugarcane cultivators engage their own pairs and labour for the manufacture of jaggery.

Side by side with the harvest, the planting operations of the new area are taken up.

After the harvest of the crop the land is used for the cultivation of the first crop of paddy.

Cost of cultivation :— The following figures give the details of the cost of cultivating an acre of sugarcane.

1.	Preparation of land.	... ...	Rs.	9	10	0
2.	Ridging and furrowing.	... ...	Rs.	7	8	0
3.	Cost of manures.	... ...	Rs.	61	0	0
4.	Manuring.	... ...	Rs.	11	0	0
5.	Cost of seed setts.	... ...	Rs.	15	0	0
6.	Planting.	... ...	Rs.	4	4	0
7.	Irrigation.	... ...	Rs.	44	0	0
8.	Final earthing up	... ...	Rs.	7	8	0
9.	After cultivation	... ...	Cost of trash			
10.	Harvesting, topping, stripping, cleaning, bundling and transporting to the mill.	... ...	Rs.	13	10	0
11.	Lease or rental on the land.	... ...	Rs.	65	0	0
12.	Cost of preparing jaggery.	... ...	Rs.	81	0	0
13.	Transport charges @ 8 as per candy for 13½ candies.		Rs.	6	12	0
	Total expenses.	...	Rs.	326	4	0

14. Average yield of canes in tons per acre ...	30 tons.	
15. Jaggery out-turn in candies of 500 lb. ...	13½ candies.	
16. Value of yield at Rs. 42 per candy of jaggery.	Rs. 567 0 0	
17. Net gain per acre.	Rs. 240 12 0	
The following figures are of interest:—		
Cost of production of 1 ton of cane. ...	Rs. 7 15 0	
Cost of production of a candy of jaggery. ...	Rs. 23 10 8	
Transport charge per candy of jaggery to the market.	Rs. 0 8 0	
Cost price of one candy when taken to the market.	Rs. 24 2 8	

With the cultivation of the improved varieties of canes and the use of improved implements, it will be possible to reduce the cost of cultivation and increase the yield and thus it will be easy to increase the net income by about Rs. 50 per acre and Rs. 2,50,000 per year for the District of South Canara.

A Note on Arrow Root in the Salur Agency.

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Indian arrow root, *Curcuma angustifolia* Telugu *Palagunda* is a wild plant growing in several parts of the Vizagapatam District. The starch prepared from the mature rhizomes is used for making milk puddings (Pala Munjalu) and it is usually prescribed as a diet for invalids. It is used as a diet during dysentry for its easily digestible qualities. The Agency taluqs of Pottanghi, Padwa, Jeypore and Nowrangapur of the Old Vizagapatam District are the chief places where it is extensively grown. The cultivation of this crop, in the sense of regular planting, interculturing and subsequent harvesting, is not regularly done in these tracts. It grows more or less wild in several blocks of waste jungle land, specially near hill streams. It thrives usually at an elevation of over 1500 feet where the soils are very rich virgin, red sandy loams. Because of its free natural growth in the hills whose elevation is usually about 1500 feet and where annual rainfall exceeds well over 50 inches and because of its abundance near water courses, one has to conclude that it requires a very rich loamy soil with plentiful water supply and a fairly cool atmosphere. Attempts will have to be made to see whether it grows well in the plains where water supply is abundant and the soil is fertile.

Preparation of the produce for the market:— The hill tribes gather the rhizomes and prepare the stuff for the market. When they are full grown, the rhizomes are dug out in the months of January and February and washed well in the streams to remove the soil. The washed rhizomes are then rubbed against pieces of stone and washed at the same time. The washings are collected in pots, filtered and the filtrate allowed to settle in shallow earthen-ware basins. The starch settles to the bottom leaving some supernatant liquid which is drained off after a while. Water is again added and the precipitate mixed well for a second wash and allowed to settle. The

supernatant liquid is again drained off. This process of washing and draining off continues until the starch is fairly white and much of the astringent and bitter taste of the same is lost and then it is allowed to dry in the sun. The dried stuff cracks well and crumbles into small pieces. The stuff is marketed as such in the local shandies. Merchants from Salur attend these shandies and buy it in the season @ 10 to 12 (addas) measures per Rupee and sell the same in the local market at 5 to 6 measures a Rupee. Much of it is exported to Vizianagaram and Vizagapatam markets as well. This is usually adulterated locally with rice starch or maize flour (Maida). These latter are mixed with water to make a thick paste and dried in the sun and broken to pieces to resemble the pure Palagunda. But experienced merchants can find out the difference between the adulterated and pure stuff, by the characterestic flavour of the latter. Palagunda also comes to the market from the Raipur side and this too is invariably adulterated as stated above.

While digging out the rhizomes, a few are left in the soil at each clump, for the next season's growth. With the advent of the monsoon, the crop grows luxuriantly and is again harvested in the months of January & February as stated above. No attempts at manuring the crop or any other cultural operations are made. Under proper cultural practices this should form a paying cottage industry and it is worth while trying to grow it in the plains where conditions permit. Improvements can also be suggested in the matter of preparation of the produce for the market. Instead of rubbing the rhizomes on stones they can be pounded in wooden or stone mortars and the pulp washed in water and filtered, and, the filtered stuff prepared for the market as usual.

SELECTED ARTILCE

Science and the Indian Peasant.

By SIR E. J. RUSSELL, D. Sc., F. R. S.

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The main facts of the agricultural situation in India so far as the peasant is concerned are set out in Table I. From this it appears that the population is increasing more than the area of land sown to crops; and, further, there is an increasing tendency to grow more saleable crops and less food crops, i. e., to get money rather than food out of the land.

TABLE I. Areas of Land Cultivated, and Utilisation per Head of Population, British India.

	Area in million acres.				
	1915—16 to 1919—20	1920—21 to 1924—25	1925—26 to 1929—30	1930—31 to 1934—35	1936—37 to Provisional.
Net area sown	220·7	222·0	226·4	229·1	231·9
Irrigated area	47·4	47·0	47·9	49·9	51·7
Food crops	210·6	209·5	208·7	214·7	216·7
Non-food crops	42·6	43·8	49·4	47·5	50·8
Fallow	54·2	51·1	49·6	49·8	48·6

	Areas per head of population.					
	1903—04 to 1907—08	1908—09 to 1912—13	1913—14 to 1917—18	1918—19 to 1922—23	1923—24 to 1927—28	1928—29 to 1932—33
Net area sown	0·883	0·906	0·918	0·879	0·868	0·841
Food crops	0·829	0·862	0·879	0·833	0·803	0·785
food crops omitting sugar	0·818	0·852	0·862	0·822	0·792	0·774
Non-food crops	0·053	0·043	0·045	0·045	0·065	0·057
Population in Millions	273·6	243·8	245·3	246·9	259·2	271·5

The total of Food and Non-food crops exceeds the net area sown, because some of the land is sown twice in the year.

On an average only 84 acres of land are used to produce the food of 100 heads of population, and in some of the more densely populated provinces only 66 acres, as compared with the 220 acres needed to feed 100 heads of population in Great Britain. Here, however, we need so much land because we eat so much meat : a vegetarian diet requires much less land and in consequence the diet in India is very largely vegetarian. Rice is by far the commonest foodstuff ; then come the millets; and finally, a long way behind, comes wheat which is further distinct in being confined to Northern India. The areas for the five-year period 1930—35 were, in million acres :—

Million acres : British India.*

Rice	80·4
Millets	39·2
Wheat	25·7

The grain crops for human food thus form about 77 per cent of the total sown area. Fruits and vegetables occupy about 2 per cent of the area sown, sugar 1·4 per cent. and other miscellaneous foods bring the total up to 82 per cent., while the remaining 18 per cent includes 4 per cent fodder crops, and 14 per cent of oil seeds, fibres and a few others The comparison with English agriculture is very striking, grain crops occupy only about 7 per cent. of the cultivated area in England and Wales ; on the other hand fodder crops for animals which form only 4 per cent. of the cultivated area in India constitute some 25 per cent in England and Wales, to say nothing of all our grass land, which adds another 60 per cent, making a total of 85 per cent. of cultivated land devoted to the production of animal food.

A remarkable feature of Indian agriculture is that the area under food crops per head of population has been falling ever since the period 1913-18, when it stood at 0·87 acres, a figure to which it had been steadily rising for at least ten years ; it was in 1928-33 only 0·78 acres, a figure lower than in any of the five preceding five year periods On the other hand, the area under non-food crops· i. e., cash crops and others, has steadily risen as the food area has fallen, and in the 1928-33 period stood at 0·57 acres per head against only 0·45 acre per head during the 1913-18 period. Three possibilities present themselves. Yields of food crops may have risen, so that the total production of food is at least as great as ever; or the money from the cash crops may be used for buying food thus possibly adding variety to the diet ; or the peasant may be getting less food than he was during the 1913-18 period. It is difficult to decide between these possibilities. Agricultural statistics in almost all countries are subject to error, especially statistics for yields. In large parts of India even the acreage figures are uncertain and figures for yield still more so shall not attempt to discuss whether yields have gone up or down, or whether the total human food

*Provisional figures for 36-37 are Rice 81·7, Millets 39·0, wheat 25·2.

production per head is better or worse than in 1913-18. The more important question is whether the present food production per head is adequate, and, if not in what directions it needs improving, and how this can be done.

The question of adequacy of diet is one for medical authority and not for an agriculturist. The present Viceroy is deeply concerned with the welfare of the peasant and is encouraging full investigations into this question A Human Nutrition Research Institute has been set up at Coonoor in the Nilgiris under the very able direction of Dr. W. R. Aykroyd, and he has provisionally suggested as the average daily requirement of a man in India, 2,600 calories, 65 grams of protein (10·4 grams of nitrogen). 45-60 grams of fat, 20 mgs. iron 0 6 gram calcium and 1 gram of phosphorus. The uncertainty about the average yields per acre makes it impossible to estimate accurately the total quantities of food produced in India, but from a number of sample enquiries it is reasonable to think that the total production satisfies both the total calorie and the total nitrogen requirements, though with little margin of safety. Dr. Aykroyd, however, emphasises the importance of biological value of proteins as well as nitrogen content, and shows that animal proteins are biologically more efficient than vegetable proteins ; he suggests that they should form at least one-fifth of the total protein in the diet. Milk, even skim milk, he points out, is the best for growing children, but eggs, fish and meat are all good sources.

These foods are almost certainly consumed in inadequate quantities. More serious is the lack of vitamins, especially of A and B; this is confirmed by the prevalence of the deficiency diseases caused thereby ; Keratomalacia caused by deficiency of vitamin A ; stomatitis due to deficiency of Vitamin B, and low haemoglobin content of the blood due to iron deficiency. The agricultural problem is thus threefold: (1) to increase the total production of foods so as to widen the margin of safety ; (2) to increase the production of milk and other animal products so as to improve the biological value of the proteins ; (3) to increase the supply of vitamins, of calcium, phosphorus, and other mineral substances.

So far we have been dealing only with averages over the whole country. But India is very vast, and it comprises many widely different regions and groups of people, and it would not be easy to ensure that every part and every class should be self-sufficing in the matter of food production. There must always be exchange between one place and another and hence it is important to increase the value of the cash crops so that the peasant may have the necessary money to buy the things he is not himself producing. This then gives the agriculturist his fourth task: to raise the value of the cash crops ; which means improving both their quantity and quality.

These tasks may be achieved in two ways: by increasing the area of cultivable land or raising its level of output ; and by improving the crops. Both methods are being adopted. There is still a considerable area of land in British India not yet cultivated, but a large part of this could be cultivated only with difficulty : -

Utilisation of land area, 1935-36, British India.

	Million acres.
Net area sown	228·7*
Culturable waste, other than fallow ...	153 1
Area uncultivable	146 0
Forest	89 8

The more hopeful method is to improve land already in cultivation so as to increase the yields and to widen the scope of cropping. The most efficient method of doing this is, in general, to irrigate it, for of all causes of infertility in India, shortage of water is the most widespread and serious.

* Not including 51, 399, 765 of fallow

Irrigation is done in three ways: (1) by wells, (2) from tank, (3) from dammed up rivers, by means of canals. Nearly a quarter of the sown area in British India is irrigated, and of this about half is watered by canals and about a quarter by wells:—

British India.		Million acres. 1934–35	1936–37.
Irrigated by-Canals	... ...	26	Provisinal.
Wells	... ...	12·5	
Tanks and other methods	...	12	
	Total	50·5	
Total area sown...	... ...	227	
Percentage irrigated	... ...	22	

All these methods of irrigation are ancient but the old method of irrigation from wells, when the lifting is done by bullocks, leaves perhaps the most abiding memory of Indian village life on one's mind. The monotonous journeying to and fro; the creaking of the windlass; the swishing sound of the water as it is discharged from the bag or bucket; these things one can never forget. The most striking contribution of science to well-irrigation has been the development of tube wells carried out to a notable extent in the Punjab and adjacent regions, where the subsoil carries plenty of water. This method has been well developed by Sir William Stampe and in places is combined with washing and bathing facilities, so that the well really becomes a centre of life for the inhabitants. Tube well irrigation is largely used for sugarcane and other valuable crops.

Irrigation from canals has been greatly developed under British rule, and indeed if the British connection with India had done nothing else, it would deserve to be remembered always for the enormous dams and irrigation systems we have set up, in order to ensure the maximum of beneficial use of the water that flows down from the Himalayas and other mountains, and might, if left alone, do great harm or at best only run to waste. I need mention only one: the great irrigation system in Sind, in which the waters of the Indus are distributed over a vast area of what would otherwise be of low productivity or even desert, converting it into fruitful land. The opening of the great Lloyd Barrage in 1932 had already brought into cultivation some 600,000 acres of land by 1935–36, besides adding greatly to the areas under cotton and wheat :—

TABLE 2. Cropping in Sind before and after the setting up of the Lloyd Barrage in 1932.

Crop	Acreage in thousands.			Production, tons in thousands		
	1913–14 1917–18	1923–24 1927–28	1933–34 1935–36	1913–14 1917–18	1923–24 1927–28	1933–34 1935–36
Cotton	264	339	649	...	...	...
Wheat	594	441	1,157	237	93	278
Rice	1,166	1,148	1,097	399	455	403
Juar*	617	549	466	187	118	103
Bajri†	679	1,064	854	164	150	99
All grain crops except wheat	3,188	3,276	2,921	814	807	669
Fruit and vegetable	44	46	49	...	...	...
Oil seeds	404	299	194	...	...	...
All crops	4,609	4,554	5,141	...	...	...

* Chiefly in Upper Sind.

† Chiefly in Middle and Lower Sind.

‡ Two years only 1934/35.

The production of cotton and of wheat has greatly increased: that of rice shows little change, but the millets and other grain crops have fallen off considerably, so that the total production of grain is less than it was. Nevertheless the cash value of the produce has much increased.

The setting up of an irrigation system is a task for the engineer, but when he has finished and retired with honours, the difficulties of the agriculturist begin. First is the question of seepage water. The canals are rarely watertight; they let the water ooze out and waterlog the adjacent soil. Many acres of agricultural land have been ruined in Sind, and whole villages have suffered subsidence. Then, there is the question of salt Sooner or later salt nearly always appears in irrigated regions. It comes up from some lower layer of the soil where perhaps it had done no harm to the crops; it reaches the surface and spreads, killing every useful plant it touches. Both sets of problems are difficult and require for their study, a good deal more fundamental investigation than they are getting. Other problems are more definitely agronomical: such as the choice of suitable systems of cropping and varieties of crops; methods of manuring; optimum quantities of water and times of application.

But all these problems are difficult, and require the services of an exceptionally competent staff. Such men are rare, and they cannot be produced by mere training. Men not up to the necessary high standard may involve the cultivators in serious loss and do irreparable damage to the whole irrigation system. These irrigated regions properly managed are a great triumph for human enterprise but there lie always within them the seeds of great tragedy.

The Punjab Irrigation Research Institute at Lahore is doing some very good work under Dr. E. McKenzie Taylor.

In regions where irrigation is impossible, but where crops usually suffer from drought, it is frequently possible to adopt special devices for making the most of the water that actually reaches the soil. These include the setting up of bunds and various cultivation devices grouped under the general name "Dry farming methods". They have been effectively studied in the Bombay Deccan.

The improvement of crop yields is effected by finding or breeding better varieties than those in common use, and by raising the level of production by better cultivation, more efficient manuring and management, and by better control of pests and diseases. I shall deal with the chief crops important to the peasant.

Rice is by far the most important crop in British India occupying 84 million acres out of the 215 million acres devoted to food crops. An enormous number of varieties occur in India of widely different types, some of them of great scientific interest, and much work has been done in classifying them, in selecting the more promising, and in breeding new sorts The foundations were laid by G. P. Hector in Bengal and F. R. Parnell in Madras, and much subsequent work has been done by K Ramiah at Coimbatore, and others. Rice is peculiar among grain crops in that many of its varieties are semi-aquatic and others entirely aquatic in their habit of growth, and this, of course, means that their manuring and cultivation are on quite unusual lines. The scientific problems associated with the growth of rice are thus of exceptional interest. They are also, however, very difficult, and the experiments have often to be carried out under very trying conditions; they involve puddling about during the hottest part of the day in gum boots in a muddy swamp infested with leeches and snakes, and made more disagreeable by mosquitoes and other insects. In spite of all this, a great number of investigations have been made, and a considerable acreage—3·6 million acres out of 84 3 million or 4 3 per cent of the total area is now sown with improved varieties It cannot be confidently asserted however, that there is any

increase in the amount of rice produced: apparently, the acreage has somewhat decreased, and it is sometimes stated, though on no good evidence, that the yields have actually not yet come to full fruition.

The *Millets* come next in importance to rice; many different sorts are grown, the commonest being Juar (*Andropogon sorghum*), Bajri (*Pennisetum typhoideum*) and Ragi (*Eleusine coracana*): the acreages are:—

	Million acres 1936-37.		
	British India.	Indian States.	All India.
Juar	23 1	13 0	36·1
Bajri	11·1	4 0	15·1
Ragi	3·7	2·8	6·5
Total ...	37·9	19 8	57·7

The millets differ fundamentally from rice in that they are dry-land crops and may receive no water except what the rain brings, though of course, if irrigation water is available it is given. They are sown just about the time the monsoon breaks so that they may obtain all the rain that comes, and they are indeed the chief crops in the non-irrigated and dry farmed regions. This great contrast with rice, explains why the two crops so often appear as complementary where the acreage of one is high, the acreage of the other is low, and *vice versa*.

Until recent years, there has been little scientific work done on the millets in India, but investigations have been started at Coimbatore, at Indore and also in connection with various dry-farming schemes. A few improved varieties have been found, but they have not spread, and the peasant has as yet derived but little benefit from the labours of the scientist.

Wheat. In regard to wheat, however, the story is quite different. Here, however, the problem was different. When the British scientific workers started investigations on wheat, their purpose was to select varieties suitable for the British market, so that the export trade might be improved The Howards were the founders of the modern work on wheat in India. David Milne studied the Punjab wheats and other workers have followed; their efforts have been so successful that some 20 per cent. of the wheat area in 1934-35 was sown with improved varieties. The word "improved," however, needs some explanation. Quality in crops is an ambiguous term: the layman often thinks it means high nutritive value; actually it generally means commercial desirability, which in the case of wheat is suitability for the English miller who will use it for blending and is not concerned with its nutritive value. In so far as Indian wheat is intended for the British market, this is obviously the standard to take. But the consumption of wheat in India is increasing, and it is estimated that some 45 per cent of the total Indian production is now consumed in the villages. In view of this changing market, obviously Indian requirements in India the wheat is not made into loaves, but into chappatties, something entirely different. It might be urged that India cannot spare grain for export, but against this, is the cogent argument that an export trade in good years affords a sure guarantee against famine in bad years. I shall not argue this question of policy, but only point out the desirability of discovering the properties needed for the making of good chappattis, and if necessary, producing and cultivating varieties of wheats possessing them.

Special reference should be made to the work on rust now being done in Northern India by K. C. Mehta.

Barley. This crop, like wheat, is of importance only in parts of Northern India; it occupies only about 6½ million acres in all British India, most of which (4·17 million acres) comes in the United Provinces. Of the rest 1·2 million acres are grown in Bihar and Orissa and 0·6 million acres in the Punjab. The barleys are of the 6—rowed type, and as these are used by English brewers, efforts have been made to breed barleys suitable for the English market. These have met with considerable success, and the Experiment Stations have sent over to this country samples which have been favourably reported on by the expert Committee of the Institute of Brewing. As in the case of wheat, however, large-scale industry has not kept pace with the plant breeder or selector and the commercial lots coming to this country fall far below the quality of the plant-breeders' samples.

We now turn to the cash crops. The two most important are cotton and sugar, but I shall confine myself to sugar partly for considerations of time, but chiefly because I studied it in more detail during my Indian journey. India is the second largest consumer of sugar in the world: the first is the United States, which in 1934—35 consumed 5·87 million metric tons; the third is the United Kingdom with a consumption of 2·28 million metric tons: while India comes in between, with a consumption of 3·35 million metric tons. An assured and abundant supply of sugar is essential to India's happiness. Some 80 per cent of the sugar is eaten as gur, or Jaggery as it is called in the south; this is the yellowish or brown mass produced on evaporating the juice of the sugarcane in an open pan; there is a certain amount of clarification. Gur has always been made in India. But about a million tons of white sugar a year are consumed also, and much of this till recently was imported. Now, however, it is practically all made in India. The production of sugar is shown in Table 3:

TABLE 3. **Sugarcane crop. Acreage and Production.**

Province and States	Area (in thousand acres) 1935—36	Area (in thousand acres) Average of five years 1930—1 to 1934—5	Yield (in thousand tons of raw sugar (gur)) 1935—36	Yield (in thousand tons of raw sugar (gur)) Average of five years 1930—1 to 1934—5
United Province (including Rampur states)	2 249	1,597	3,336	2,063
Punjab...	473	446	358	336
Bihar	465	313	668	371
Bengal	325	274	560	330
Madras	131	114	360	322
Bombay (including Sind and Indian States)	121	99	313	256
North-west Frontier Province ...	58	49	63	55
Mysore	50	38	53	36
Hyderabad ...	59	38	99	60
	3,931	2,918	5,810	3829

*From Department of Commercial Intelligence and Statistics, in India Trade Journal Supplement, May 21st 1936.

The figures were still higher in 1936—37 though they appear to have fallen in 1938—39. The establishment of sugar production in India on so firm a basis is the direct result of the breeding experiments started by Dr. Barber, and especially his happy crossing of *Saccharum spontaneum* with the sugarcane, which yielded new varieties of great vigour and power of growth. This work has been ably

continued by Rao Bahadur Venkataraman and in consequence, India is now provided with a number of varieties suited to the various regions. These new sorts have almost ousted the old ones; some 80 per cent. of the area planted with sugarcane is under new varieties. Notable advances were made in the cultivation methods by G. Clarke at Shahjahanpur (1912—1930). Much of the success of the sugar industry is due to the improvements effected by technical chemists and engineers in the factories under the stimulating influence of Sir Harcourt Butler, and there is still scope for further efforts.

Fruit and Vegetables. I have spoken earlier on the shortage of vitamins in the ordinary diet of the peasant. An obvious remedy is an increase in the consumption of fruit and vegetables. A wide range of fruits can be grown in India; ordinary European fruits in the hills of the north and tropical fruits in the plains. Much work is now being done on the subject, though it is not clear that the area under these crops has yet increased. No area figures are available, but it is estimated that about 2½ million acres are devoted to fruit.

Milk and livestock. There is a fair consumption of milk in parts of the Punjab and some of the hill districts, but in general, the consumption is far too small. It is stated that the average daily ration of milk in the Punjab is 10 oz. while in Bengal, Madras and the Central Province it is only 2 oz. or less. This is bound up with the general livestock problem which in India is very difficult and is complicated by the fact that the Hindus regard the cows as a sacred animal and refuse to kill ineffective animals; in consequence the meagre supply of animal food has to be spread over a large animal population, many of which give no adequate return.

Dr. Norman Wright recently reported on this milk question so that it is unnecessary for me to discuss it. Scientific work on the subject is being done, subject to the limitations inherent in the problem. One hopeful line is the improvement of the grazing lands in the forest areas as this deals also with another difficult problem, soil erosion, which, however, lies outside the scope of this lecture.

The effect of the improvements resulting from scientific investigations. Table 4 shows the approximate areas sown with improved varieties. The greatest success has been with sugarcane. But wheat and rice represent a considerable achievement in view of the large acreage involved. It must be remembered that there is no honest seed trade in India which can take over the multiplication and distribution of improved varieties of crops. as is done in Great Britain; all this in India must be done by the overworked officials of the Department.

Time does not permit any description of the advances made by scientific, workers in knowledge of the fertilizer requirements of crops, or in methods of cultivation but these have been considerable. Under the Imperial Council of Agricultural Research, further great improvements may confidently be expected.

The full result of the scientific work, however, is not shown in this Table but rather in the high levels of yield and quality obtained at the experiment stations. These are not infrequently double or treble the yields obtained by the peasants. The great problem in Indian agriculture is not so much to acquire new knowledge as to bridge this gap between peasant practice and experiment station achievements.

The Causes of Frustration of Agricultural Science in India. There are several reasons for this wide gap, but in my view the two most potent are the poverty of the peasants and the lack of an educated agricultural middle-class.

There are, of course, many zamindars and other landlords and farmers who take a direct interest in their land and their people, and who do much to raise the standard of farming. But they are exceptional, and broadly speaking there is a serious lack of leaders in the agricultural community to take over agricultural improvements from the experiment stations and put them into practical form modified to suit the local conditions. The educational system has not produced this type of man and although there are agricultural colleges, the students only rarely take up farming.

TABLE 4. Approximate proportion of area sown with improved seed.

Crop.	Total acreage. Million acres.	Acreage under improved seed. Million acres.	Percentage.
Sugarcane	4·10	3·27	81·7
Jute	2.18	1·3	58·6
Wheat	33·61	8·5	25·3
Cotton	26·00	5·04	19·20
Rice	83 43	4·58	5·5
Groundnuts	5 86	0·22	3·40
Millets	38·69 *	0 34 ‡	Not calculated as figures
Gram	16·90	0·33 ‡	are incomplete

*Including Jawar, Bajra and Ragi only.

‡ Not separately reported by some provinces.

In their defence it must be said that the acquisition of agricultural land by an outsider is often difficult, and the villages are singularly unattractive places in which to live. Poverty, dirt and disease are still rife in spite of years of effort to get rid of them. But at last the efforts are beginning to tell; a widespread movement for improving village life is being fostered, not only by the British but also by the best of the Indians themselves, and is spreading over the country. Already many of the villages have been cleaned up; wells have been walled in; the streets freed from garbage and other refuse which is now used to make compost heaps; mango trees have been planted and the roads improved. We can only hope that, when the villages become fit for educated people to live in, they will go and live there. Already a beginning has been made in the Punjab for example, steps have been taken to settle graduates on the land and some 8,900 acres of land have been colonised by 162 educated young men, of whom 89 comprise the entire cultivating population of four villages and the remainder are scattered in pairs, over villages where it is hoped they may exert a profound influence for good. But in the meantime, many of the agriculturists are too poor to be able to undertake any but the simplest changes. Many of the peasants are very shrewd, with a considerable knowledge of their soils and crops. But they are hampered by ineffective cattle and implements, by lack of manures and by lack of money. Special methods are needed for passing the knowledge gained at the experiment stations over to the peasant and showing him how to use it in his daily work so as to reduce the poverty which at present so much hampers progress. What India needs now is not so much new scientific knowledge about general agriculture, but fuller use of existing knowledge and the working out of methods to reduce the present wide gap between the ordinary cultivator and the experimental farm. Fortunately all parties seem to have agreed on the vital necessity of improving the lot of the peasant, and we can look forward with confidence to the result of the many beneficent agencies working to this end. (*Journal of the Royal Society of Arts*, No. 4512 May 1939).

ABSTRACTS

Little leaf—A transmissible disease of brinjal (*Solanum melongena*) by K. M. Thomas and C. S. Krishnaswami: *Proceedings of the Indian Academy of Science.* Vol. X, No. 2. August 1939; 201—212 2 Pl.

A disease of brinjal (*Solanum melongena*) causing reduction in the size of leaves, shortening of internodes, stimulation of axillary buds, phyllody and sterility, prevalent in many parts of South India was investigated by the authors. The disease was found to be transmissible from diseased to healthy plants by grafting, and not by sap inoculation. A jassid '*Eutettix phycitis*' found on brinjal in Coimbatore was able to transmit the disease under experimental conditions, and would appear to be the chief vector of the disease in the field. The disease has a wide host range among solanaceous plants. Tomato, tobacco, *Datura fastuosa, Solanum xanthocarpum, and S. trilobatum* are the hosts mentioned. The disease could be controlled by roguing affected plants, and removal of solanaceous weeds from the field.

The absence of any constantly associated organism in the affected plants together with the general nature of the disease lead the authors to conclude that, the disease is of virus origin. (Authors' abstract).

Seasonal variations of starch content in the genus Rosa and their relation to propagation by cuttings. Brandon, D., *Jour. Pom. and Hort Sci.* Vol. XVII. 233—253 1939.

A series of experiments were carried out to ascertain the rooting capacities of various varieties and species of rose. Hardwood cuttings were taken at intervals during winter and the highest rooting percentage was obtained during the period October-December. Soft wood cuttings were inserted in summer and June was the best time for rooting.

The cuttings were exposed to various chemical treatments before planting and B-indolyl acetic acid (1/10000 to 1/50000) and glucose (1%) increased rooting percentage slightly. No treatment was found to give a pronounced increase or acceleration in rooting. Two different pH values of the solutions used had no effect on subsequent rooting.

The different varieties and species showed varying types of starch fluctuation during the season, falling into two groups.

The value of plant hormones or their substitutes in plant propagation. W. T. Brown., *Malay. Agric* J., 1238. 26; 414-9, bibll. 12. The general principles of the functions of plant hormones in root production are described and the application to practical horticulture of the knowledge now available is discussed. Plants may be classed as to their normal habits of rooting from cuttings, as easy, but slow, and difficult. The easy ones require no treatment with synthetic growth substances though they respond well to them by accelerated rooting. The easy but slow are usually evergreens which take a year normally but when treated will root in 6 to 8 weeks. Efforts to strike difficult cuttings by the aid of growth substances have not been markedly successful. In all cases response to synthetic growth substances has been largely confined to leafy cuttings; leafless cuttings seldom respond. *Horticultural Abstracts 9 (1939)*: 8.

Application of growth substances to increase rooting capacity in cuttings of woody species and shrubs. D. A. Komissary, C. R. Acad. Sci. U. S. S. R. (Russian) 1938. 18: 63—6. Winter and summer cuttings of 18 deciduous trees, shrubs and conifers were treated with 0·020 to 0·001 % water solutions of B—indolylacetic acid for 6 to 72 hours. Results are tabulated. A higher percentage of rooted cuttings, greater root system and earlier rooting was determined

after application of the optimal concentration, which varied from 0·02 to 0·005 % according to species. An interesting result was achieved with *Picea excelsa*, the cuttings of which are difficult to root. Cuttings made in June and treated 24 to 32 hours with 0·005 % solution of heteroauxin rooted up to 93 %. The effect of phenylpropionic, phenylacetic acid, anaphthalene acetic acid, urine and maize flour extract was similar but less pronounced than that of heteroauxin. The compounds proved ineffective on some species. The effect of growth substances depends on the plant species, age of plant, wood development and time of taking cutting. (*Horticultural Abstracts* 9 (1939) : 6)

EXTRACTS

Silage making by the Forest Department. The Forest Department experimented for the first time in Kurnool District with making of silage to serve as fodder for cattle during the hot months.

Two pits were dug each 10 feet by 15 feet and eight feet deep in Sidhout and Vontimitta Ranges of this Division. These pits were filled with green grass on 29th September 1938 and 21st October 1938 respectively.

In the pit in the Sidhout Range, 11·02 tons of fodder grass *Heteropogon contortus* (spear grass) and *Schema nervosum* (*nendra* grass) were put in. The weather was wet at the time of collection and of filling in of pits and the pit had to be covered with a tent to prevent rain getting in.

In the pit in Vontimitta Range, 10 tons of grass were loaded mostly *Heteropogon contortus*. The weather was not so wet in September and that probably accounted for the difference in weight in the two cases, the dimensions of the pits being the same. Grass was well pressed in the pit and trampled by cattle. In the green state, it stood two feet above ground level. Earth was banked on four sides and a top covering of two feet of earth laid, after all the grass had been loaded, to make the pits water-tight. Gradually the pit contents shrank to about six feet depth from bottom with the weight of the load of earth on top. The earth was shaped pyramid fashion to drain off water on all sides.

The pit in Sidhout Range was opened on 13th April 1939, i. e., eight months after formation, to see what the silage was like. About 100 cattle were brought from neighbouring villages to feed on the silage. The cattle greedily ate the silage offered. The Deputy Director of Agriculture who was present when the pit was opened pronounced it to be quite good.

The grass in the pit when first opened was quite warm to the touch and had a sweetish, tobacco smell—not quite offensive and yet not pleasant.

The cost of construction was as follows ;—

Construction of pit	Rs. 7—4—0
Collection of green grass at annas four per bundle of 150 lbs.	Rs. 41—3—0
Covering, etc.	Rs. 4—0—0

The silage taken out was offered free to cattle that were invited to the feast. Quite three-quarters of a ton was thus distributed free. The balance—about 6 tons—was sold to ryots who readily purchased it at nine pies per 60 lbs.

The only criticism which the Deputy Director had to offer was that we did not cover up the top and sides of the grass heap with mat or green leaves to prevent soil mixing with the edible silage.

We propose to try making silage with bamboo leaves and *Yepi* (*Hardwickia binata*) in other centres. From the way the ryots appreciated this demonstration, it looked as though it would not be difficult to persuade the influential ryots in

forest villages to try this method of storing green fodder in time of scarcity. If our experiments with bamboo and *Hardwickia* also succeed, it should not be difficult to get a little revenue too by this method of preserving green fodder for cattle.

The Deputy Director of Agriculture lucidly explained in Telugu the method of forming silage and its use in times of scarcity. (*The Indian Forester*, LXV (1939) 582—583).

The Cultivation of Cinchona in India. It appears probable that we shall soon be having a big development in the cultivation of cinchona in India. Towards the end of the year 1937 it may be recalled that the Imperial Council of Agricultural Research, set on foot an enquiry into the prospects of cinchona cultivation in India and appointed Mr. A. Wilson, Deputy Director, Cinchona, Madras to conduct the enquiry and also associated with him Dr. T. J. Mirchandani, Agricultural Chemist, Bihar, as Soil Chemist. The Report of these officers which has just been published as Mis. Bulletin No. 29 of the Council, goes fully into the subject, giving an account of the present situation and prospects and an equally interesting survey of the nature and extent of the efforts in the past. It may not be generally known that India is already a fairly large producer of quinine from locally grown cinchona bark and that in the past it was producing much larger quantities. The present annual production is put down as some 70,000 lbs. of quinine; until about the year 1880 she was a much larger producer, the estimated quantity of bark per year at that time being as much as 950 000 lbs, or an output of nearly 2 lakhs pounds of quinine—facts which amply demonstrate that India has the soil and climate suitable for producing a large quantity of her requirements of the drug. This important factor, viz, India's requirements, is estimated variously. The author estimates it at 6 lakhs of pounds. He also refers to other authorities who estimate it at 12½ lakhs of pounds or over twice the first estimate. This is further complicated by the fact that in reality, India is consuming only 210,000 lbs. per year or only a third of the lesser of the above two estimates. An account is also given of the difficulties which the Government met with, in disposing of their stocks; comsumption fell from 80,000 to 60,000 lbs. even though prices became cheaper by 30 per cent. and the demand could not be increased even when the stock was offered for sale at a big sacrifice in price. Altogether we cannot help thinking that this matter of the quantity which India will absorb is decidedly obscure and needs to be clarified. We wish also that a statement had been furnished to show the consumption per year for a period of, say the last 10 or 15 years. Anyhow the report takes 210,000 lbs. of quinine as the annual requirement; of this quantity local production supplies at present 70,000 lbs. and the remainder is imported. The immediate objective therefore is to grow enough cinchona in the country to produce this 140,000 lbs. of quinine that is now imported. The report further envisages the need for producing the much larger quantities referred to above and contains suggestions to that end also.

Land considered promising for cinchona cultivation in many parts of India, notably the planting districts of South India, Assam, Bengal and Orissa, and the Andaman Islands have been surveyed, soil analyses and profile studies made, and the requirements in this regard discussed.

Altogether, an area of some 38,000 acres have been specified as suitable and additional tracts are indicated for further similar inspection, if a much larger production should be contemplated, though for the planting programme of twelve years at the rate of 3.333 acres annually stated as required for the latter larger production, this 38,000 acres appear sufficient. Government planters and small holders are all suggested as suitable agencies for the growing of the plants. We

may point out in this connection that no information to show what money return can be expected from the cultivation of cinchona is available in the report, although this is an all-important factor, at least as far as the private planter is concerned whether large or small. The cost of production is however given in detail; a statement of the prices paid for bark, or the unit price that has ruled for the last ten years or so, will have greatly added to the usefulness of the report. We should also like that analyses had been given of the soils of certain Anaimalai estates where bark with a high quinine content of 11% was being produced, and likewise of the soils of the Tavoy plantations which are stated to have been a disastrous failure although the area was selected by one of the greatest experts in cinchona.

The species *ledgeriana* is the one recommended to be grown. It is gratifying to learn that 72% of the cinchona grown in India at present is *ledgeriana*, and that among these some extraordinarily good areas may be seen. The need for research is emphasised on the famous Java model and a strong plea put in for a research station for isolating better performing strains of *ledgeriana*, for their multiplication as plants on their own roots or grafted on to *succirubra* stocks, for nursery technique and so on. Such a station is in our opinion long overdue.

Much has been accomplished even as the result of grafting the *ledgeriana* on to the less exacting *succirubra* in Java, a comparatively easier line of work which we are told is being done with great facility by ordinary coolies trained for the work, at the rate of some 300 to 500 grafts per day for a set of two coolies; it should be possible to undertake this work at least straightaway on the present Government plantations themselves. It is stated that this was attempted but was not persisted in. The point is further stressed that unless this better species and better yielding types among them are grown, it will not be possible to reduce the cost of production. This cost of production will probably be the rock on which schemes of expansion and continuance will split; motives of self-sufficiency are not likely to stand the strain of the ever present and insistent claims for economy, especially if large supplies of cheaper quinine should be available from Java or other foreign sources. The lines of expansion indicated in the report are cautious and sound: we hope suitable action will soon be taken to give effect to the recommendations. (*S. K. Y. in Current Science*, Vol. 8. No. 9 September 1939).

Gleanings.

Spraying and Photosynthesis. The application of a spray fluid for the control of insects or fungi has usually been regarded solely from the pathological point of view. R. A. Hyre has shown, however (Cornell Univ. Agr. Exp. Sta. Memoir 222, Ithaca, N. Y., April 1939), that certain sprays lower the photosynthesis of the plant to which they are applied. Lime-sulphur may even reduce it by as much as 28 per cent at ordinary summer temperatures, but Bordeaux mixture, on the other hand, has little effect. Emulsified sulphur pastes were found to be intermediate in their effect upon photosynthesis. Respiration was not markedly affected by spray fluids. Studies upon such factors as the biennial bearing of tree fruits show that these plants cannot sustain any considerable loss of photosynthesis with impunity. The loss in anabolism through spray applications is not of many days' duration but it is likely to occur at the critical time of flower bud formation, when the extent of the subsequent year's crop is being determined. The use of Bordeaux mixture instead of lime-sulphur in the summer spray programme would provide a practical means for the achievement of pathological control without physiological disturbance. (*Nature*, Vol. 144, No. 3644, Sept. 2, 1939, p. 447–448).

The Control of Silver-fish. Silver-fish, at times, cause serious damage to the surfaces of photographs, book-covers, wall papers, starched clothing, linen and other materials They shun the light, and unless disturbed are not often seen during the day. Cupboards and book cases, etc. which are not frequently used, provide shelter and breeding grounds for them.

Silver-fish are wingless insects and are covered with smooth, glistening scales, which in the common house species (*Ctenolepisma longicaudata*) are silvery grey in colour. The whitish eggs are small and rounded, and the young forms resemble the adults.

Control. Where silverfish are known to congregate in numbers and are readily reached by a spray, a kerosene-pyrethrum mixture (or fly spray) may be used.

The spray mixture may be prepared with the following materials :—

Pyrethrum powder.	...	...	4 oz.
Kerosene.	...	...	1 quart.
Methyl salicylate (synthetic oil of wintergreen).			⅜ fluid oz.

Place the pyrethrum powder in the kerosene, mix and shake well, then allow to stand for about twelve hours. Strain through fine muslin and add the methyl salicylate, after which the spray is ready for use.

A poison bait which has been found effective in controlling silverfish may be prepared with the following substances :—

Flour.	...	...	..	1 oz.
Sugar.	...	...	...	1½ oz.
Barium fluosilicate.		...	...	1¼ oz.
Water.	...	...	...	½ pint.

To prepare, make the flour and sugar into a paste with the required amount of warm water and then stir in the barium fluosilicate.

The baits are readily prepared by spreading the poisoned paste with a paint brush on sheets of thin cardboard, about two feet square. Both sides of the cardboard should be painted, and when dry, cut up into small pieces measuring about two inches by three inches.

From 10 to 20 baits are used in an average-sized room, and they should be left undisturbed in parts where the silver-fish are usually seen. The baits should be kept out of the reach of children. "*The Agri. Gaz. N. S. Wales*", Vol. L, (1939): 438.

A Simple Ant Bait. During the past three years very satisfactory results have followed attempts to clean up invasions by the small black ant, *Iridomyrmex rufoniger*, in houses in Sydney, by baiting with a relatively simple mixture of honey and arsenic. The bait is made by mixing :—

			By weight.
Arsenite of soda (80 % As_2O_3)	...	...	1 part.
Water.	...	...	16 parts.
Honey.	...	...	288 parts.

These proportions are most easily arrived at by stirring thoroughly into 18 oz. (by weight) of honey, 1 fluid oz. of a solution of arsenic containing 1¼ oz. of the arsenite of soda per imperial pint.

Commonly recommended baits for sweet-eating ants almost all contain very much more water than the above mixture and usually contain preservatives. They are more complex to prepare. Some at least lose their toxicity or attractiveness as a result of a mould growth when kept in partially-emptied bottles

Samples of the simple honey and arsenic bait stored for eighteen months in half-filled bottles grew no mould (presumably because of the high concentration of sugars), retained their odour of fresh honey, and were readily eaten by small black ants. As with freshly prepared bait, the colonies of ants observed fed on 18-months-old mixtures for some few hours and then disappeared. A small teaspoonful of the bait, or the amount adhering to half a dozen wooden matches dipped in it, was enough to give the desired result in several houses in Sydney. It is suggested that no more need be offered to any colony at a time. The amount of arsenic in a small teaspoonful of bait is approximately equal to a large medicinal dose for a human being (one-sixteenth of a grain). This honey-arsenic bait is not attractive to the small red ant, *Monomorium pharaonis*.—R. N. McCulloch, Assistant Entomologist in (*Agri. Gaz. of N. S. Wales* 50 (1939): 348).

Correspondence.

To

The Editor, Madras Agricultural Journal.

School Gardens.

Sir,

In the matter of School gardens, India is at present far behind other countries. In America and England they are found scattered all over the country. In a country almost wholly agricultural like India, the children should be taught not merely the ordinary indoor curriculum of the elementary school but advantage should be taken of the child s longing for the open air and for playing at work, to develop its powers of observation and the acquiring of practical information from the material provided in the school garden, for arithmetic, mensuration, drawing composition and nature study in a living actual form. A good many people look upon school gardening as having for its object the cultivation of a few vegetables and flowers and nothing more, Even so, it would be of some value in teaching the boys and girls to be neat and methodical, useful and resourceful. The possibilities and usefulness of a school garden, however, are far greater than this, The school garden teaches the children to become interested in plant life, to use their hands while realising that it is not undignified to work and to take a new interest in their surroundings. It also enables them to add fresh and often new vegetables to the home supply or to obtain a little money from their sale, as a result of their healthy out-door work. In other countries, it has been found that the school garden course has developed the children physically, mentally and morally, turning out healthy, bright and quick-witted children.

The training that a boy has received in the ordinary village school garden, even supposing that he is not going to earn his living as an agriculturist, will have developed in him the habits of industry, economy, thrift, method and resourcefulness and will have sharpened his powers of observation.

Some of the more important uses of school gardens are, to serve as object lessons in the cultivation of useful plants, to encourage children to establish gardens at their homes. If tackled in the proper way, the school gardens might serve as centres for the distribution of useful seeds of improved varieties of common seeds, together with information about them to induce the cultivator parents to take up the cultivation of a new or improved variety.

With land and labour available in the schools, it is now possible to start a garden which will repay its cost many times over owing to the cheapness with which seeds of excellent varieties are now available from seedmen. A

Prices.

Age.	Milk yield.	Prices ranging From	To
		Rs.	Rs.
Cows-Ongole.			
1st and 2nd calving	2--3 Madras Measures.	70	90
	3--4 " "	90	110
3rd and 4th calving	2--3 " "	60	70
	3--4 " "	70	100
Buffaloes-country.			
1st and 2nd calving	2--3 " "	50	70
	3--4 " "	70	100
3rd and 4th calving	2--3 " "	50	60
	3--4 " "	60	85
Others.			
Buffaloes-Delhi.		120	150
Cows-cross-bred.		120	180

Market Report No. 22.

Madras, Friday the 1st December 1939.

With the advent of clear weather, arrivals of cows and buffaloes from the Ongole tract have increased The demand for milch cattle has not increased owing to continued fodder scarcity. Prices are steady.

The stock movements during the week were as follows:—

	Stock at Commencement.	Arrivals during the week.	Sale during the week.	Balance.
Cows-Ongole	94	103	97	100
Buffaloes-country	111	105	96	120

Prices.

Age.	Milk yield.	Price ranging From	To
		Rs.	Rs.
Cows-Ongole.			
1st and 2nd calving	2—3 Madras Measures.	70	90
	3—4 " "	90	110
3rd and 4th calving	2—3 " "	60	79
	3—4 " "	70	100
Buffaloes-country.			
1st and 2nd calving	2—3 " "	50	70
	3—4 " "	70	100
3rd and 4th calving	2—3 " "	50	60
	3--4 " "	60	85
Others.			
Cows-cross-bred.		120	180

Market Report No. 23.

Madras, Friday the 8th December 1939.

The arrivals of cows and buffaloes are steadily increasing and the quality of stock has improved. The demand is moderate and prices are steady.

The stock movements during the week were as follows:—

	Stock at commencement.	Arivals during the week.	Sales during the week.	Balance.
Cows—Ongole	100	163	123	140
Buffaloes—country	120	175	135	160

Prices:

Age.	Milk yield.	Prices ranging From	To
Cows—Ongole		Rs.	Rs.
1st and 2nd calving	2—3 Madras Measures	70	90
	3—4 " "	90	110
3rd and 4th calving	2—3 " "	60	70
	3—4 " "	70	100
Buffaloes—country			
1st and 2nd calving	2—3 " "	50	70
	3—4 " "	70	100
3rd and 4th calving	2—3 " "	50	60
	3—4 " "	60	80
Others			
Cows—cross-bred		120	180

(1 Madras measure of milk = 4 lbs.)

Crop & Trade Reports.

Statistics—Crop—Sugarcane 1939—Intermediate condition report. The condition of the sugarcane crop is generally satisfactory outside South Arcot where the crop is reported to have been affected slightly by stem-borer in parts. The yield is expected to be normal in all districts outside the Circars, South Arcot, North Arcot and Tanjore where it is estimated to be slightly below normal.

The wholesale price of jaggery per imperial maund of 82 2/7 (equivalent to 3,200 tolas) as reported from important markets on 4th December 1939 was Rs. 9—14—0 in Adoni, Rs. 9—2—0 in Vizagapatam, Rs. 7—8—0 in Cuddalore, Rs. 7—7—0 in Salem, Rs. 7—4—0 in Vellore, Rs. 7—3—0 in Rajahmundry, Rs. 7—1—0 in Vizianagaram, Rs 7—0—0 in Bellary, Rs. 6—15—0 in Erode, Rs. 6—14—0 in Chittoor, Rs. 6—9—0 in Cocanada, Rs. 6—7—0 in Trichinopoly, Rs. 5—11—0 in Mangalore and 5—4—0 in Coimbatore. When compared with the prices published in the last report i. e., those which prevailed on 6th November 1939, these prices reveal a rise of approximately 10 per cent in Bellary, 8 per cent. in Vizagapatam and Coimbatore, 7 per cent in Vizianagaram and 6 per cent. in Adoni and Erode and a fall of approximately 13 per cent. in Chittoor, 11 per cent. in Cocanada, 10 per cent in Rajahmundry, 7 per cent. in Cuddalore and 3 per cent in Mangalore, the prices remaining stationary in Vellore, Salem and Trichinopoly. (*From the Director of Industries, Madras*).

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 22nd December 1939 amounted to 476,116 bales of 400 lb. lint as against an estimate of 388,900 bales of the total crop of 1938—39. The receipts in the corresponding period of the previous year were 521,110 bales. 410,440 bales mainly of pressed cotton were received at spinning mills and 181,867 bales were exported by sea while 142,580 bales were imported by sea mainly from Karachi and Bombay. (*From Director of Agriculture, Madras*).

College News and Notes.

Students' Corner. Students' Club – *The Hostel Tatler*:— The second number of the *Hostel Tatler* for the year, was published during this month. This is the first time that two issues are published in the same year and the students are to

be heartily congratulated on their effort in this direction. The Editorial board of the Hostel Tatler deserves great praise for the collection and proper editing of the materials published.

Dr. (Mrs.) Muthulakshmi Reddy addressed the students on 26—11—39 with Mr. K. C. Ramakrishnan, M. A., Lecturer in Economics, University of Madras, in the chair.

A debate "That in the opinion of the house a composite cabinet of Government is better suited to India than a single political party Government" was held on 29—11—39 with student Rajashekara Chetty in the chair. Mr. M. Kanti Raj was the observer.

Travancore Curzon Memorial Lectures. Under the auspices of the Madras University, Mr. K C. Ramakrishnan, M. A., Lecturer in Economics, University of Madras, delivered a course of three lectures on 24th, 25th and 27th November 1939 on "Factors in Agricultural Development". The Lectures were greatly appreciated and a large number of students and officers attended the meetings.

Association of Economic Biologists. A meeting of the above association was held on 11th December in the Freeman building with Mr. M. C. Cherian, President of the Association in the chair. Two papers were read and discussed. The first paper was on "Some mutation in Rice" by C R. Srinivasa Ayyangar and N. Parthasarathy. The second paper was on "Studies on soil moisture as affected by the frequency and method of irrigation in Cambodia cotton" by V. Ramanatha Ayyar and N. C. Thirumalachari.

Farewell to Mr. M. Kanti Raj. Mr. M. Kanti Raj, M. A., B. Sc., Junior Lecturer in Agriculture and Asst. Superintendent, Central Farm, was entertained at a farewell party on 9—12—39 by the students of the College, on the eve of his transfer as Assistant Director of Agriculture to St. Thomas Mount, Madras.

We are glad to announce that Mr. N. G. Charly who was till recently Research Engineer in this Department has been awarded the Gold Medal by the Imperial Council of Agricultural Research, for his improvements in the circular water lift. This is the second time an officer of this Department receives such an honour, the first being Mr. K. T. Thangavelu, who was offered the silver medal for his designing a turmeric polisher.

Visitors. Mr. H. M. Hood, adviser to His Excellency the Governor of Madras visited the Agricultural college and Research Institute on 21—12—39.

Mr. P. H. Rama Reddy, Director of Agriculture, Madras, stayed in the Estate from 20th to 22nd December.

Indian Central cotton committee. At the invitation of the Government of Madras the winter session of the Indian Central Cotton Committee will be held at the Agricultural College and Research Institute between the 15th and 20th of January 1940. Elaborate arrangements are being made by the reception committee for the reception to be accorded to the members of the committee.

Hindi Class. Hindi night classes have been started in the estate which are attended by over 25 officers of the Department. Great enthusiasm exists among the Hindi adherents, to master the language.

Weather Review—NOVEMBER 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st	Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·3	-3·7	31·0	South	Negapatam	25·2	+7·5	55·3
	Calingapatam	0·7	-3·2	28·9		Aduthurai *			
	Vizagapatam	3·5	-0·2	32·6		Madura	5·4	+0·5	36·2
	Anakapalli*	3·9	-0·1	39·6		Pamban	16·5	+4·5	26 8
	Samalkota*					Koilpatti*			
	Maruteru*	8·6	+5·3	50·5		Palamkottah	7·7	+0·3	17·5
	Cocanada	7·7	+2·3	59·7					
	Masulipatam	6·3	+0·6	47·7					
	Guntur*	1·2	-2 0	34·6	West	Trivandrum	18·2	+11·6	71·1
					Coast	Cochin	10 0	+3·5	133·7
Ceded	Kurnool	3·6	+2·4	20·0		Calicut	6·1	+0·8	115·3
Dists.	Nandyal*	0·0	0·0	0·0		Pattambi *	8·4	+4·7	97·1
	Hagari *	0·4	-1·0	21·3		Taliparamba *			
	Siruguppa*	0·1	-1·4	21·3		Kasargode *	3·8	-0·1	113·8
	Bellary	1·6	-0·6	18·5		Nileshwar*	5·7	+2·5	121·3
	Anantapur	1·2	-1·6	28 8		Mangalore	3·9	+0·8	116 3
	Rentachintala	2·9		28·2					
	Cuddapah	3 8	+0·2	26·5					
	Anantharaju-pet*	10 8	+2·0	32·3	Mysore	Chitaldrug	5·9	+3·6	34·1
					and	Bangalore	2·8	-0·1	35·2
Carnatic	Nellore	12·3	+1·0	37·0	Coorg	Mysore	2·7	+0·1	30·2
	Madras	13·0	-1·3	32·8		Mercara	5·6	+2·3	104·7
	Palur*	20·4	+8·0	53·4					
	Tindivanam *	12·4	+2·0	40·3					
	Cuddalore	21·0	+5·9	66 5	Hills	Kodaikanal	24·5	+16·3	69·6
						Coonoor			
Central	Vellore	10·6	+3·7	39·9		Ootacamund *	20·4	+14·3	67·6
	Salem	4 4	+0·6	47 9		Nanjanad *	9·1	+5·2	52·01
	Coimbatore	4·0	+0·4	25 0					
	Coimbatore A. C. & R. I.*	4·8	Nil	26·7					
	Trichinopoly	18·0	+12 5	51·1					

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1937 published in the Fort St. George Gazette.

Weather was unsettled in the Bay off the South Madras Coast early in the month when a shallow depression formed by the 7th, but became unimportant by the 9th. Unsettled conditions appeared in the Andaman sea on the 8th and moving out westwards on the 10th became unimportant by the 13th. A deep depression appeared in the southwest of the Bay on the 15th, and developing rapidly into a cyclonic storm of great intensity crossed the coast near Negapatam in the early hours of the morning of the 16th, but weakened equally rapidly but persisted as a trough of low pressure over south east Madras and extended to the North Madras Coast till the 21st when it became unimportant. Thereafter weather over the Presidency was generally dry.

Another depression formed in the Central Bay of Bengal on the 25th which however failed to affect weather in the Presidency.

During the passage of the depression in the Bay from the 15th till it disappeared, rainfall was locally very heavy in South East Madras and heavy in parts,

of the South Circar Coast. Rainfall was in excess in the southern districts Carnatic, parts of Circars, Travancore and the Hills.

Chief falls of rain were:

Trichinopoly 11·7".
Usailipatty 13·8".
Keeranur (Pudukottah) 11·3".
Pudukottah 10·7".
Ootacamund 8·1".
Ernakulam 8·2". All between 16th and 17th.

Weather Report for the Research Institute Observatory.
Report No. 11/39.

Absolute maximum in shade.	...	86·3°F.
Absolute minimum in shade.	...	63·5°F.
Mean maximum in shade.	...	83·1°F.
Departure from normal	...	-1·4°F.
Mean minimum in shade	...	68·9°F.
Departure from normal	...	+0·4°F.
Total rainfall for the month	...	4·81"
Departure from normal	...	Nil.
Heaviest fall in 24 hours	...	2·24" on 16th.
Number of rainy days	...	6
Mean daily wind velocity	...	0·8 mile per hour.
Departure from normal	...	-1·4 m. p. h.
Mean humidity at 8 hours	...	84·6%
Departure from normal	...	+4·0%

Summary. The rainfall of 4·81 inches during the month was just normal 3·52 inches of this was received during the 3rd week of the month. The heaviest fall of 2·24" was on the 16th. Skies were moderately to heavily clouded and the humidity was in excess. The mean maximum temperature was below normal. The mean minimum temperature was very slightly above normal and the mean daily wind velocity was below normal.

Departmental Notifications.

Gazettee Notifications.

Transfers.

Name of Officers.	From	To
Sri. M. Kanti Raj Naidu,	Offg. Junior L. A., and Supdt. Central Farm, Coimbatore.	Asst., D. A., St. Thomas Mount.
„ A. Ramaswami Ayyar,	Offg. Asst, D. A., St. Thomas Mount, Madras.	Offg. Asst., D. A., Tiruppattur.
„ V. T. Subbiah Mudaliar,	Offg. Asst., D. A., Tiruppattur.	Offg. Asst., D. A., Pattukottai.
Nawabzada Saddat-ul-lah Khan Esq.,	D. D. A., (on leave.)	D. D. A., Trichinopoly.
Sri. T. Murari	Supd. Live Stock Research Station, Hosur.	A. D. A. Pattukottai.

Subordinate Services.

Transfers.

Name of Officers.	From	To
Sri. K. Achuthan Nambiar,	Asst. A. D., in Mycology, Tellicherry.	Asst., A. D. in Mycology, Coimbatore.
Janab A. Azimmudin Sahib,	A. D. (on leave.)	A. D., Kulitalai.
Sri. V. V. Rajagopalan,	A. D. on Special duty under the S. G. S., Nellikupam.	Offg. Asst. in Entomology, Coimbatore.
„ K. Venkataswami Naidu,	A. D., Palladam.	A. D., Rapur; Nellore.
„ J. V. V. Suryanarayana,	A. D., Rajampet.	A. D., Rayachoti.
„ K. C. Thomas,	F. M. Central Farm (on leave.)	A. D., Palladam.
„ S. Veeravarada Raju,	A. D., Madanapalle.	A. D., Sriperumbudur.
„ E. Kunhappa Nambiar,	Gazetted Asst, to the Principal, Coimbatore.	F. M., in charge of the Central Farm.
„ A. Gopalan Nair,	Agricultural Upper Subordinate (on leave.)	F. M., Central Farm, Coimbatore.

Leave.

Name of Officers.	Period of leave.
Janab K. Soopi Haji Sahib, Offg. F. M., Sim's Park, Coonoor.	L. A. P. for 2 months from 4—1—1940.
Sri. K. Saptharishi, A. R. S., Aduthurai.	L. a. p. for 1 month from 3—1—40.
„ U. S. Aiyaswami Ayyar, A. D., (on leave.)	Extension of l. a. p. on m. c. for 3 months in continuation of leave already granted.
„ M. Subba Reddi, A. D., Rayachoti.	Extension of l. a. p. on m. c. for 2 months from 8—11—39.
„ K. Govindan Nambiar, A. D., Choyyar.	L. a. p. on m. c. for 4 months from 22—11—39.
„ A. P. Balakrishnan Nair, A. D., Omalur.	Extension of l. a. p. on m. c. for 2 months from 21—11—39.
„ V. N. Subannacharya, A. D., IInd Circle.	L. a. p. for 3 months from the date of relief.
„ E. Kunhappa Nambiar, F. M., Central Farm, Coimbatore.	L. a. p. for 4 months from 3—1—1940.

UNIVERSITY OF MADRAS

B. Sc. Degree Examination in Agriculture, 1939.

FIRST EXAMINATION

AGRICULTURE

Monday, 3rd April. 7 A M. to 10 A. M.

Maximum : 60 marks.

Answer six *questions*. Questions 1 and 3 are compulsory.

*1. How is the study of meteorology useful to ryots? What are the instruments used by the Government Agricultural Chemist, Agricultural College for measuring meteorological elements? Describe briefly how each of those instruments is utilized. (12 marks.)

2. What is climate? How does a knowledge of climate help the ryots in their agricultural practices? (9 marks.)

*3. State the effect of the following operations on sandy loams under garden land conditions:— (*a*) sowing one day after receiving 1 inch of rain. (*b*) applying tank silt at 100 cart-loads per acre, (*c*) ploughing soon after heavy rain, (*d*) applying ammonia sulphate and superphosphate.

What will be the effect of the above operations on 'black' cotton soil under dry land conditions? (12 marks.)

4. Sketch and describe briefly the mechanical seed drill. What are the advantages of sowing crops with drills? (9 marks)

5. What are the important weeds growing on the Central Farm? How would you control their spread? Which of them could be controlled and which could be completely eradicated? (9 marks)

6. What are the different methods of raising paddy nurseries? Give in detail the various operations to be done for preparing a seed-bed to raise seedlings for transplanting one acre. What is the seed rate and area of seed-bed required for planting one acre of fertile land? (9 marks.)

7. What are the objects of tillage? What are the implements you would use to prepare one acre of garden land to sow cambodia cotton in lines? (9 marks)

8. Describe with diagrams the various parts of a monsoon plough and indicate the functions of (*a*) bridle, (b) landslide, (*c*) mouldboard. (9 marks)

BOTANY

Tuesday, 4th April. 7 A. M. to 10 A. M.

Maximum : 60 marks.

Answer six *questions*. Questions 3 and 5 are compulsory.

1. Enumerate the modifications of roots and stems that are met with in flowering plants. Give examples. (9 marks.)

2. Make sketches of the vascular bundles in the stem of a dicotyledon and explain the roles of the various tissues. (9 marks.)

*3. Group the following plants in their respective natural orders:— (*a*) *Gossypium indicum*, (*b*) *Sesbania aculeata*, (*c*) *Hevea braziliensis*, (*d*) *Arachis hypogaea*, (*e*) *Ricinus communis*, (*f*) *Hibiscus esculentus*. Give reasons. (12 marks.)

4. Name the constituents of a typical living plant-cell. How do the cells divide? (9 marks.)

*5. What are the essential elements of plant food and how do plants obtain them? (12 marks.)

6. What are the sources of energy in plants? How do plants expend energy? (9 marks.)

7. Describe meiosis in detail and mention its significance. (9 marks)

8. Write short notes on:— (*a*) auxin, (*b*) seed, (*c*) vegetative reproduction, (*d*) tendrils, (*e*) aril, (*f*) cambium. (9 marks.)

CHEMISTRY

Wednesday, 5th April. 7 A. M. to 10 A. M.

Maximum: 60 marks.

Answer six *questions.* Questions 3 and 5 are compulsory.

1. Starting from carbon and hydrogen, how would you prepare acetylene, ethylene, and ethyl alcohol? Mention the chief products of ethyl alcohol. What test would you make to detect its presence? (9 marks.)

2. What do you understand by the term 'isomerism'? Illustrate your answer by taking $C_2H_5NO_2$ as an example.

Describe briefly the methods of preparation and the main characteristics of the two classes of substances which can be represented by the molecular formula $C_2H_5NO_2$. (9 marks)

*3. Describe briefly the Victor Meyer methods of determining the molecular weight of a volatile substance.

0·3921 grams of a substance on analysis gave 0·6800 grams of carbon dioxide and 0·0695 grams of water: further 0·2961 grams gave 0·4186 grams silver chloride when heated with nitric acid and silver nitrate. The vapour density of the substance was found to be 101·5. Find the molecular formula. (12 marks.)

4. Name the sugar that is present in milk and describe its method of preparation from milk. Mention its chief properties and *two* tests you would make to identify it. Are the products of its hydrolysis identical with those of maltose? (9 marks)

*5. Explain how you would prepare dimethyl benzene by the Friedel and Crafts reaction. Of the three dimethyl benzenes, ortho, meta, and para, mention which is formed by the above reaction and explain why that particular compound is produced. (12 marks.)

6. Write a short account of the general methods of preparation and chief properties of the aromatic halogen substitution products containing the halogen on the nucleus. (9 marks.)

7. Describe the commercial preparation of salicylic acid and mention its chief properties. Mention a popular drug or antiseptic prepared from it and state its formula. (9 marks)

8. From what source is phenol obtained commercially? What are its properties? How do phenols differ from alcohols? (9 marks.)

ZOOLOGY

Wednesday, 12th April. 7 A. M. to 10 A. M.

Maximum: 60 marks.

Answer six *questions.* Questions 3 and 7 are compulsory.

1. Describe with the aid of diagrams the life-history of any Sporozoan organism you have studied. (9 marks).

2. Explain the terms 'secretion' and 'excretion'. Describe the structures connected with excretion found in paramoecium, earthworm, and frog (9 marks).

*3. Compare the cross-section of Hydra with that of the earthworm. In what respects does the earthworm show a higher degree of organisation than Hydra? (12 marks).

4. What are Molluscs? Classify them, giving examples. State their economic importance. (9 marks).

5. Describe how respiration is effected in the following: (*a*) Earthworm, (*b*) Cockroach, (*c*) Scorpion, (*d*) Fish, (*e*) Frog. (9 marks).

6. Explain what is meant by 'metamorphosis' among insects. Classify the orders of insects based on this phenomenon. (9 marks).

*7. 'Insects are the most highly organized of the invertebrates'. Discuss the validity of this statement. (12 marks).

8. Write short notes on the following:— (*a*) Polymorphism, (*b*) Hermaphrodite, (*c*) Peripatus, (*d*) Coelome, (*e*) Setae, (*f*) Eruciform larva. (9 marks).

SECOND EXAMINATION

AGRICULTURE PLANT HUSBANDRY. I

Monday, 3rd April. 7 A. M. to 10 A. M.

Maximum: 100 marks.

Answer six *questions*. Questions 1 and 5 are compulsory.

*1. What are the systems of housing cattle to conserve farmyard manure effectively? Which would you recommend to (*a*) a rich ryot owning a large stock, (*b*) a ryot of poor means, (*c*) a ryot owning dairy cows? Give reasons. (18 marks.)

2. How does a good rotation of crops maintain the fertility of the soil? What is the rotation adopted in the dry lands of the eastern block of the Central Farm? (16 marks)

3. How many wells are there in the western block of the Central Farm which are used for irrigation and how many acres does each well irrigate? Which of them is suitable for fixing (*a*) a Persian wheel, (*b*) a single mhote, (*c*) an electric motor-pump? Give reasons. (16 marks.)

4. What are the improvements you can suggest in the cultivation of the following crops:— (*a*) paddy, (*b*) irrigated cotton, (*c*) mangoes? (16 marks.)

*5. Describe in detail the cultivation of sugar-cane in the wet lands of the Central Farm. What are the manures applied and on what basis are the various quantities of manures fixed? Which is the best variety of cane grown and what will be the average yield in tons per acre? (18 marks.)

6. What are the different systems of propagating fruit trees? Which do you consider the best way to propagate sapotas? (16 marks.)

7 How is the potato cultivation done in the Nilgiris? What improvements have been introduced by the Agricultural Department? (16 marks)

8. What are the various methods of treating seed before sowing for prevention of diseases? When, and how, are the following used:— (*a*) Ceresan, (*b*) Bordeaux mixture, (*c*) sulphur? (16 marks.)

AGRICULTURE. PLANT HUSBANDRY. II

Tuesday, 4th April. 7 A. M. to 10 A. M.

Maximum: 100 marks.

Answer six *questions*, Questions 1 and 5 are compulsory.

*1. Compare the working of the following water-lifts:— (*a*) ordinary mhote, (*b*) circular mhote of South Arcot, (*c*) Persian wheel of Cooper or Kirkloskar make, (*d*) Picottah. What quantity of water will be lifted by each in one hour and at what cost? (18 marks).

2. Write in detail about the cultivation of any *one* of the following crops:— (*a*) gingelly, (*b*) potatoes, *or* (*c*) turmeric. (16 marks).

3. Is tobacco grown under rain-fed conditions in this Presidency? If so, state the most ideal conditions of soil and rainfall for the purpose and compare the quality and yield with irrigated tobacco. (16 marks).

4. In what respects does garden-land farming in Coimbatore district differ from that of the Chingleput district? Give reasons. (16 marks).

*5. Fifteen acres of garden land are planted with Sathugudi orange seedligns, Sathugudi budded plants, and grafted mango plants in equal areas. Compare the yields of each and state which you would consider to be most profitable and why. (18 marks).

6. Write brief notes on the following;— (a) why moisture is important in the soil, (b) how water is held in the soil. (c) how the moisture-holding capacity of the soil can be increased. (16 marks).

7. State the most important oilseed crop of this Presidency. What methods are being followed in growing the same, and what is the normal cost of production per acre? (16 marks).

8. A well in Pelavore village in Tinnevelly contains sixteen mhotes and commands 60 acres of land. The supply of water is unlimited throughout the year. What crops and how many would you raise in a year? Is it advisable to substitute a pump instead of the mhotes? If so, state the economic advantages of the same. (16 marks).

AGRICULTURAL ENGINEERING

Wednesday, 5th April. 7 A. M. to 10 A. M.

Maximum: 60 marks.

Answer six *questions.* Questions 4 and 8 are compulsory.

1. Explain the methods you would adopt for accurately locating selected points in a chain survey, compass survey, plane table survey. Mention what precautious have to be taken and what are the limits of accuracy possible with each method. (9 marks.)

2. What are the essential qualities of sand, lime, and cement used for the preparation of mortar? In what proportion and in what manner should they be mixed to prepare lime mortar and cement mortar? Explain briefly the differences in setting of lime and cement mortars. What is 'surki' concrete and what are its uses? (9 marks).

3. What are the appliances used in a small size dairy? Describe briefly the process of pasteurization of milk. Explain the nature and use of the different appliances required. (9 marks).

*4. Design a pump-house for a centrifugal pump and an oil-engine for pumping water for irrigation. Show the relative position of the pump to the well. The pump-house may be 8 feet by 10 feet with wooden truss and roofing of Mangalore tiles. (12 marks).

5. Describe a tractor you are familiar with. What are the uses and limitations of such a machine on a large farm? (9 marks).

6. Describe with sketches the mechanism of (a) a seed-drill, (b) a simple type of power-driven thresher, (c) a centrifugal pump. (9 marks).

7. What are the usual defects met with in timber? Name the principal varieties of timber used in building construction and state for what purpose they are best suited.

Describe the process of creosoting timber. What are the advantages of timber so treated? (9 marks).

*8. Describe the principle of working of a simple steam-engine and a compound condensing steam-engine. Name and sketch the auxiliary units in each case. What are the advantages and limitations of a steam-engine plant on a farm? What other kinds of prime movers offer better advantages? (12 marks).

AGRICULTURAL ZOOLOGY

Wednesday, 12th April. 7 A. M. to 10 A. M.

Maximum: 60 marks.

Answer six *questions.* Questions 2 and 7 are compulsory.

1. Describe the mechanism by which silk is produced in insects. What are the insects producing silk of commercial value? Discuss the prospects of sericulture under South Indian conditions. (16 marks.)

*2. What do you understand by the terms major and minor pests? State briefly the major pests of paddy in the Madras Presidency under the following heads:—(*a*) name of the insect and its distribution; (*b*) life-history and nature of the damage done; (*c*) methods of control. (18 marks.)

3. State the general distinguishing features of Diptera. Give an account of the economic importance of the group. (16 marks.)

4. Give familiar instances of the use and methods of application of the following in insect control:— (*a*) calcium arsenate, (*b*) tobacco decoction, (*c*) carbon bisulphide, (*d*) pyrethrum powder. (16 marks)

5. Explain the term 'adaptation'. What are the various adaptations shown by insects as means of protection from their enemies? (16 marks.)

6. Write a short account of 'balance of life in nature' with special reference to insects. (16 marks.)

*7. Samples of sugar-cane setts and stored paddy seed intended for dispatch to a foreign country are supplied to you. What are the insects that are likely to be found in them? What precautions would you take to make the samples pest-free? (18 marks)

8. Write short notes on:— (*a*) viviparous, (*b*) entomophagous, (*c*) nymph, (*d*) honeydew, (*e*) ecdysis, (*f*) cutworms. (16 marks)

ANIMAL HYGIENE

Friday, 14th April. 7 A. M. to 10 A. M

Maximum: 60 marks.

Answer six *questions* Questions 2 and 7 are compulsory.

1 Name the different regions of the vertebral column of a bullock. How many vertebrae are there in each region? Describe briefly a typical vertebra and compare it with those in other regions (9 marks.)

*2. Draw a diagram of the stomach *in situ* of a cow. Name its compartments and state their relative position. Explain what part each compartment takes in the digestion of starch and proteid foods. (12 marks)

3. Define the following terms and give an example for each:— (*a*) diuretic, (*b*) demulcent, (*c*) deodorant. Give the uses and doses of the following for full-grown cattle:— (i) asafoetida, (ii) butea seed, (iii) common salt. (9 marks.)

4. Describe the line of action you would take in the case of cough in a bullock. (9 marks.)

5. What is castration? Why is it practised on domestic animals? What are the methods employed in castration, and what are the advantages and disadvantages of each? Which method would you prefer? Give reasons. (9 marks)

6. What is oestrum? What are its signs in cows? How long does it last in cows, ewes, sows, and buffaloes, and when does it appear after parturition in these animals? (9 marks.)

*7. Write in detail what you know about foot and mouth disease. How would you differentiate it from rinderpest and cowpox? (12 marks.)

8. How do you treat the following:— (*a*) displacement of the horn, (*b*) bumble foot, (*c*) a clean-cut wound? (9 marks.)

FINAL EXAMINATION

AGRICULTURE—ECONOMICS AND FARM MANAGEMENT

Monday, 17th April. 7 A. M. to 10 A. M.

Maximum: 100 marks.

Answer six *questions.* Questions 1 and 3 are compulsory.

*1. How many acres are under garden land cultivation and dry land cultivation in the western block of the Central Farm? Give in detail the cost of equipping the western block with work cattle and implements. What will be the cost of cultivation, gross and net income of growing the cash crop in the three-course rotation adopted in field No. 54? (18 marks).

2. Illustrate and discuss the layout of 10 acres of orange garden in Coimbatore. Assuming that there is a good well, work out the cost of digging pits, irrigation channels, and planting seedlings from the Fruit Research Station, Koduru. (16 marks).

*3. Describe briefly how you made the rural inquiry in Singanallur village. Give in detail the method and cost of cultivation of betelvine in one acre and work out the profit or loss per acre. (18 marks)

4. Discuss the advantages and drawbacks of large scale and small scale farming. In your opinion which is more suitable for Indian conditions? Give reasons (16 marks.

5. What are the main systems of land tenure and types of leases in the Presidency? Discuss briefly the effect of the ryotwari system on the introduction of improvements in agriculture. (16 marks.)

6. What is meant by experimental error? What part does the 'Latin square' play in modern experimentation, and what are its merits and demerits? (16 marks.)

7. What is the system of farming adopted by ryots in the black cotton soils of Bellary district? What will be the gross and net income of a ryot owning 100 acres in one year? What improvements could you suggest to him to enhance his income from the knowledge you have gained by visiting the Agricultural Research Station, Hagari? (16 marks.)

8. What are the irrigation charges of a sugar-cane crop per acre from the time it is planted till it is cut when the source of water is (*a*) a well with a single mhote, (*b*) a well with a Persian wheel? (16 marks.)

AGRICULTURE—ANIMAL HUSBANDRY

Tuesday, 18th April, 7 A. M. to 10 A. M.

Maximum: 100 marks.

Answer six *questions.* Questions 1 and 6 are compulsory.

*1. Madura municipality is interested in starting a co-operative dairy society in order to supply hygienic milk to at least fifty thousand people, and butter to five hundred people. Prepare a scheme stating the finances required and the number of cows and the equipment that would be necessary. (18 marks).

2. It is advisable to grade foreign cockerels like White Leghorns or Rhode Island with country hens. Is this grading practised in this Presidency and, if so, with what results? Compare the number of eggs laid by the crosses with the mother hens.

Give the feeding costs and egg production of one dozen White Leghorn and one dozen Light Sussex hens in a year. (16 marks).

3. Describe the process of butter-making as practised by ryots in the villages, and compare it with that made in a dairy. What will be the ratio between milk and butter in each case?

Compare the keeping quality of the butter in each case, and explain the difference if any. (16 marks).

4. What is meant by the saying 'a bull is half the herd'? What points would you consider essential in an ideal bull for breeding purposes? Does a breeding bull require a special ration? If so, why? (16 marks).

5. It is stated that there are no really good milking breeds of cattle in the Madras Presidency. Explain fully the reasons for the same, and suggest how the present conditions can be improved. (16 marks).

*6. It is stated that India has more cattle than are actually required or can be properly maintained. How many cattle (cows, she-buffaloes, and bullocks) in your opinion can a ryot profitably maintain in this Presidency on a farm of 250 acres dry land, 85 acres wet land, and 50 acres garden land? Support your statement with facts and figures. (18 marks).

7. What points would you take into consideration when purchasing a cow for milk and a pair of bullocks for work? It is stated that animals, like people,

are most useful when they are contended. State how you would achieve this. (16 marks).

8 It is stated that Madras Presidency has more sheep than any other Province in India. State into how many classes the chief breeds of Southern India are divided. Describe the special characteristics of each. (16 marks).

AGRICULTURAL BOTANY. I

Wednesday, 19th April. 7 A. M. to 10 A. M.

Maximum: 100 marks.

Answer six *questions*. Questions 3 and 6 are compulsory.

1. Write an account of the various factors that determine the nature of a 'plant community'. (16 marks.)

2. Narrate the salient features in Vavilovs' theory of the origin of cultivated plants. (16 marks.)

*3. Classify the fibre-yielding plants of the Madras Presidency according to the families to which they belong. and mention in each case the particular part that is the fibre. (18 marks)

4. Give the distribution and describe the diagnostic characters of the main groups of 'sorghum' in the Madras Presidency. (16 marks)

5. Give, with examples, an account of the many devices that result in cross-pollination in crop plants. (16 marks.)

*6. Describe with figures the floral structure and the method of pollination in the following crop plants:--(*a*) rice (*b*) cotton, (*c*) ground-nut. (18 marks.)

7. Choose *four* local weeds and describe the special equipments that enable each of them to compete with crops for the possession of arable land. (16 marks.)

8. Describe fully the principles and practices involved in the horticultural practice of 'grafting'. (16 marks.)

AGRICULTURAL BOTANY. II

Thursday, 20th April. 7 A. M. to 10 A. M.

Maximum: 100 marks.

Answer six *questions*. Questions 1 and 5 are compulsory.

*1. Indicate how the knowledge of the life-history of the fungus is useful in finding out the control measures for the following diseases:— (*a*) short smut on cholam, (*b*) red-rot of sugar-cane, (*c*) mahali on areca nut, (*d*) die-back or pink disease of mango. (18 marks).

2. Compare and contrast the modes of nutrition of fungi and green algae. (16 marks).

3. Describe the modes of reproduction on 'phycomycetes' and 'basidiomycetes'. (16 marks).

4. What are the distinguishing characteristics of 'mosses' and 'ferns'? (16 marks).

*5. Discuss the bearing of the following statement on the breeding of sugarcane: 'Vegetatively the plant multiplies but remains the same: through sex it changes.' (18 marks).

6. Write a short account of the 'theory of natural selection' or the 'mutational theory of evolution'. (16 marks).

7. In a cross between two varieties, viz. resistant and susceptible. F_2 ratio of 13 resistant to 3 susceptible was obtained. How would you explain the above result? (16 marks).

8. Write short notes on:— (*a*) segregation, (*b*) linkage, (*c*) polyploid, (*d*) karyokinesis. (16 marks).

AGRICULTURAL CHEMISTRY. I

Friday, 21st April. 7 A. M. to 10 A. M.

Maximum: 100 marks.

Answer six *questions*. Questions 4 and 5 are compulsory.

1. Describe briefly how you would make a mechanical analysis of soil. What is the special importance of the clay fraction? (16 marks)

2. The amount of water contained in the soil at any time is a balance between gains and losses. State these gains and losses. Explain the meaning of surface tension and the part it plays in the distribution of water in the soil. (16 marks.)

3. Give a brief account of the various methods, both chemical and biological, which have been tried for bringing atmospheric nitrogen into a state of combination suitable for agricultural purposes. (16 marks.)

*4. What are sedimentary rocks? How are they classified? Give a short account of the geography of India in the cretaceous period. What is the name assigned to the South Indian formations of this period? What is its importance? (18 marks).

*5. Describe briefly the changes which have taken place in the method of manufacture of basic slag, and the effect of these changes on its composition. Mention its chief properties and the class of soil to which it is generally applied. (18 marks).

6. Describe the process by which fresh straw or organic material could be made to rot down to a condition of well-rotted manure. What are the chief points elucidated by the process, and how can they be applied to the manufacture of natural farmyard manure? (16 marks).

7. Give an account of the unitary method of valuing manures. If sodium nitrate 15 per cent. nitrogen costs Rs. 120 per ton, superphosphate 32 per cent. water soluble phosphate costs Rs. 180 per ton, and Kainite 12 per cent. potash costs Rs. 60 per ton, what is the value of one ton of a mixed manure containing 12 per cent. nitrogen, 24 per cent. water soluble phosphate, and 4 per cent. potash (N, 14; O, 16; Na, 23; P, 31; K, 39; Ca, 40)? (16 marks).

8. Give an account of the contribution made to the theory of the nutrition of plants by Boussingault and Liebig. (16 marks).

AGRICULTURAL CHEMISTRY. II

Monday, 24th April. 7 A. M. to 10 A. M.

Maximum: 100 marks.

Answer six *questions*. Questions 2 and 6 are compulsory.

1. Write short notes on the following:— (*a*) Kellner's starch-equivalent (*b*) oxidizing enzymes of milk, (*c*) unsaponifiable ether extractives of cows' milk. (16 marks.)

*2 'The value of a feed depends upon the nature and amounts of the cleavage products which it yields on digestion rather than upon the specific substances it contains'. Discuss this statement, illustrating as far as possible with the feeding standards in local practice. (18 marks.)

3. Comment on the following:— (*a*) protective principles found in plants, (*b*) role of asparagine in the nitrogen metabolism of plants, (*c*) protein requirements for growth, (*d*) first sugar of photosynthesis. (16 marks)

4. How many distinct classes of proteins are there? What are their more important physical properties? Indicate the chemical structure of the basic group. (16 marks.)

5. Describe suitable experiments for testing:— (*a*) fructose in the presence of glucose, (*b*) lactose in the presence of maltose, (*c*) globulins in milk, (*d*) peroxidase in the tuber of the potato. (16 marks.)

*6. Explain clearly the meaning of the pH scale. Describe how you would measure the pH of a sample of milk. (18 marks.)

7. Explain clearly the meaning of net energy of a feed. Discuss the principles of the methods of computing them. (16 marks.)

8. Describe in detail the reactions involved and the differences in the nature of curd formation by (*a*) souring, (*b*) the action of rennet. (16 marks).

Date of issue.	Date of issue.	Date of issue.
7.1.48	15.6.1961	
2.4.48	17.10.61	
30.6.48	23/12/63	
[illegible]		
14.7.50	29.12.64	
11.9.50	25.6.65	
19.9.50	10-9-85	
13.10.50	6 DEC 1985	
18 AUG 1954		
10-11-52		
24-12-56		
4-5-58		